AUGUST 25, 1952

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

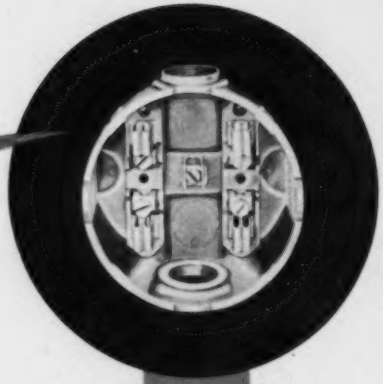
How Do YOU Look at Electric House Heating?

LEVITTOWN, PA.

Handles the Load

with Murray

MATCHED EQUIPMENT



Outdoor Meter Socket. Supplied with four jaws which are reversible for vertical or horizontal mounting. Hubs are locked in permanently. Socket and hubs made of corrosion resistant steel, finished in gray, baked-on Melamine.

Levittown, Pa., a new city of 16,000 homes, is rising in the eastern part of Pennsylvania. Each house is fully equipped with the most modern electrical conveniences. To handle the load, two Murray companion units were installed — the Murray Meter Socket and the Murray "Main and Range."

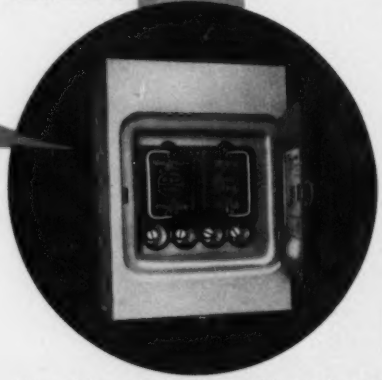
When Levitt and Sons, the nation's largest builder, specifies equipment, you can be sure that it is high quality and easy to install.

One out of 16,000 houses being built at Levittown, Pennsylvania. Murray Meter socket is located on outside wall, rear. Murray "Main and Range" located in a utility room, backs it up on the inside.

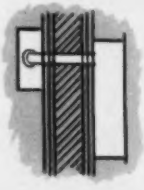
Murray Can Supply Both Meter Mounting And Service Entrance Equipment

For a few homes—or thousands—Murray matched equipment will make the job easier. Matched equipment is easier to wire and easier to install because the units are designed to fit together. Matched equipment looks neater, too. That's why contractors—whether working on a bungalow or a huge development, like to buy and install Murray Combination units. They're designed to fit together.

Electricians like Murray equipment because it is easy to install. There's always plenty of wiring room, in Murray equipment!



Main and Range with four branch lighting circuits. Two pullout type switches — fusible. Solderless pressure connectors. Baked-on gray Melamine finish.



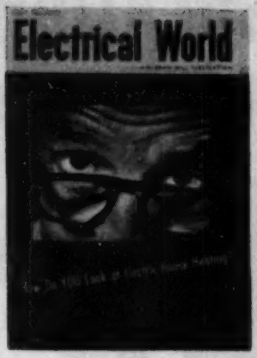
Murray Meter Socket and Main and Range back up to each other. This saves on wire and makes the wiring job easier. Permits more adequate wiring all around.

Ask your jobber about Murray Matched Equipment. It's designed to go together.

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance & Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D) • Current Limiting Reactors • Crows'nest Aerial Ladders



ON THE COVER

This quizzical looking gent is asking you a question, How do you look at electric house heating? This is one of the big controversial questions that the industry must answer within the next five years. There are many sides to it. Two of them are presented on Page 96.

When these opposing viewpoints arrived in the shop, the editors took a holiday and sent them to the printers without editing them. They even forgot to put down the names of the authors and their companies. But these thought-provokers should start a lengthy stream of letters to the editor.

NEWS FAST, ENGINEERING ALMOST AS

Engineers are methodical guys who are quick on the action and slow on the talk. EW does not have too much trouble in getting the news of the industry fast. Getting engineering stories is another matter. But here is one time when an engineer came right in on the heels of the news.

On July 21 (Page 9) EW carried a story of the 161-kv interconnection between Kansas City Power & Light Co and Union Electric Co of Missouri. On Page 88 is a story by J. R. Miller, KCP&L, telling of the unusual relaying problems which had to be solved when the big tie-line was tapped to serve two major loads. This is an interesting and informative account of how the relay engineers licked the problem.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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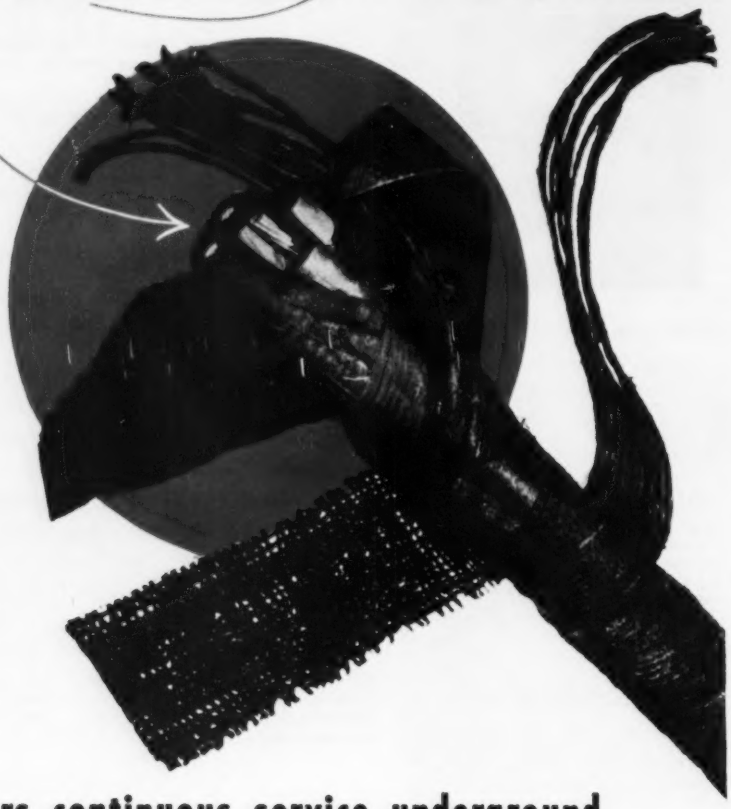

Good as New

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Another check on the performance of Hazard Watertite Insulation was made possible recently when a utility moved a length of cable that had been buried nearly 15 years. A section of this cable was forwarded to Hazard where the insulation was subjected to exhaustive physical and electrical tests. Result . . . still in the prime; capable of many more years of reliable service.

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Watertite Insulation is used in a great many Hazard Wires and Cables for power distribution systems, control and branch circuits, indoor or outdoor feeder systems, mine installations and street lighting circuits. Where operating conditions demand maximum moisture resistance and electrical and physical stability, Watertite Insulation is recommended. Its high dielectric strength and insulation resistance, plus low power factor and low mechanical and electrical moisture absorption, assure long life under the severest service conditions. Write for Bulletin H-436. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

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THE flexibility of the entire line of Brown instruments makes available a variety of combinations well qualified to meet the measuring, recording and signalling demands of any power plant. And the standardization and interchangeability of components simplify maintenance and stocking of parts.

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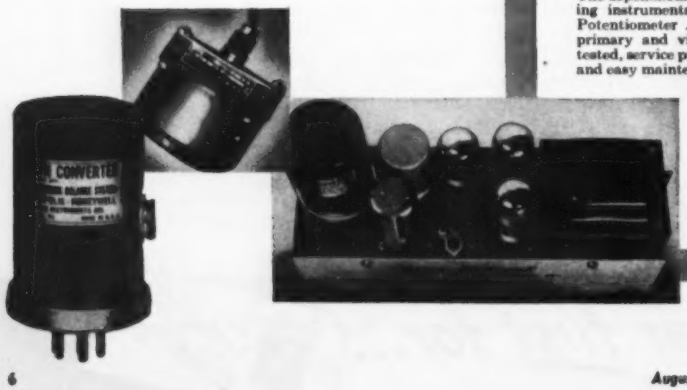
Dependability, Too!

The dependability you demand from your recording instruments is insured by the *ElectroniK* Potentiometer... by the dependability of its primary and vital components which are life-tested, service proven, and designed for minimum and easy maintenance. It takes little more than a glance to appreciate the ruggedness of the positive balancing motor, the hermetically-sealed converter, the simplified continuous balance amplifier... as well as the minimum of moving parts and the obvious freedom from adverse effect of dust and atmospheric moisture.



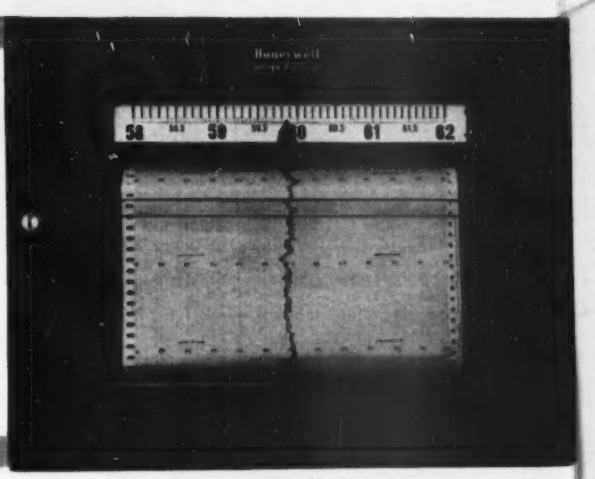
ElectroniK Potentiometers

frequency measurement...

THE *ElectroniK* FREQUENCY RECORDER

Important Features

- *Continuous Balance measuring system—with electronic non-cyclic balancing—not mechanical in operation.*
- *Frequency change as small as 0.01 cps initiates rebalancing action.*
- *Calibrated accuracy within 0.025 cps at normal frequency.*
- *Unit construction eliminates delicate mechanical linkages . . . assures long trouble-free operation with minimum of maintenance.*



THE *ElectroniK* Frequency Recorder is a *must* for central stations and systems offices. It provides an *uninterrupted* check on generator performance by its instantaneous measurement of frequency . . . furnishes accurate, permanent records . . . and makes load dispatching easier.

Operating on the electronic "continuous balance" principle, the recorder features unusual sensitivity and dependability. Its balancing motor and mechanism move only during a frequency change, thus reducing wear of parts to an absolute minimum. Its scale—12 inches wide—makes for easy readability at a distance, for checking the direction and amount of frequency deviation.

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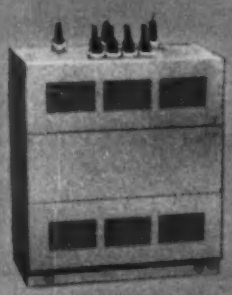
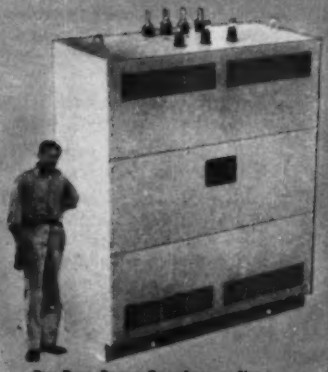


Dry Type Distribution Transformer. Note large ventilation grilles.

POWER



Dry Type Power Transformer. Sizes available up to 3000 KVA-15 KV.

Uptegraff Dry Type Distribution and Power Transformers are made in standard sizes and ratings up to 3000 KVA-15 KV. Features that mean long life, efficient operation and dependability are: well-ventilated coils for elimination of hot spots; integrated design of core and coil assembly for top level performance with respect to short circuit forces; class B insulation, steel and porcelain structural parts for durability.

Prompt deliveries can be arranged.

Noise-Level Tested

Every Uptegraff Dry Type Transformer must pass a noise level test before shipment.

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Scottdale, Penna.

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In many public squares there stands an old piece of ordnance—silent for 364 days of the year, fired once on the 4th of July.

In many companies there are periodic operations—things that need doing once a year, once each quarter, or at irregular times. These range from the design of a new power plant to the quarterly disbursement of dividends, from a rate study to counsel on financing, or other corporate matters.

Probably you have found that "tooling up" personnel and facilities for these periodic or infrequent operations can be disruptive and costly; just as unsatisfactory as investing in an annually-used cannon.

But such operations are part of Pioneer's constant, complete service, for Pioneer is like public utility service itself—broad in application, efficient and economical in use, paid for only as used.

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$f(x, y, z)$ = Protective Performance

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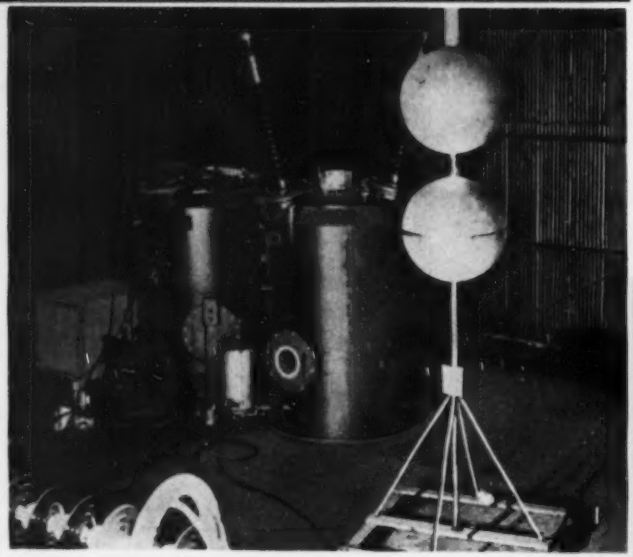
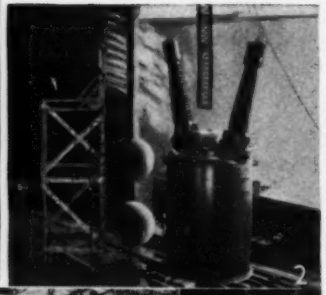
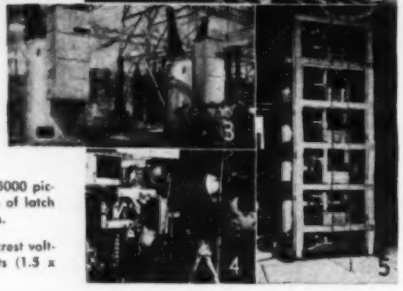
embody the "X" factor to a high degree







PACIFIC'S TEST PROGRAM IN ACTION

is partially shown by these views

1. Pole Unit of 161-kv, 10,000,000 kva, Type RHE withstands 365 rms kv, 60-cycle.
2. Pole Unit of 230-kv Type RHE withstands 445 rms kv, 60-cycle, under water spray of wet test.
3. An at-site setup for field test of interrupting rating, using two units at 230 kv. Interruptions to 9,600,000 kva (ASA) at 240 kv were obtained—the maximum from the generating facilities available.
4. High-speed camera, making 3000 pictures per sec, records motion of latch linkage during design studies.
5. Impulse Generator used for crest voltage tests to two-million volts (1.5 x 40-ms wave).

CIRCUIT BREAKER Performance is a function of several factors, of which the manufacturer's test program is but one. However, this "x-factor," as some call it, deserves as much attention when selecting circuit breakers as does any of the tangibles.

Pacific Electric's facilities and arrangements for testing, and their use by trained test personnel, have contributed significantly to the reputation that Pacific breakers enjoy among today's application engineers.

Design tests cover such matters as insulation withstand (60-cycle and impulse), interrupting time and current, momentary and 4-sec high currents, the continuous-current heat run, and check of mechanical features (the 5000-operation design test).

Noteworthy is Pacific's policy of field testing at locations where maximum interrupting current may be obtained at full voltage and high recovery rates. Seven such field test programs have been completed during the last five years; they avoid need of extrapolating from laboratory tests in which one or more of the elements may be missing.

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Hotpoint, with a tradition of close cooperation and understanding of utility problems, has taken the initiative in promoting **all-electric living** across the nation. Hundreds of thousands of America's homes are boasting all-electric kitchens and home laundries as a result of Hotpoint's pioneering and never-ending promotion of **all** the ingredients of the all-electric home.

And now, to aid in creating a better balanced and more profitable domestic electrical load, we have available for you new studies on "Balanced Revenue Through Selective Selling" and "Consumer Survey Plans for Retail Salesmen." You can get full information on these studies by writing the Utility Division, Hotpoint Co., 5600 West Taylor Street, Chicago 44, Illinois.

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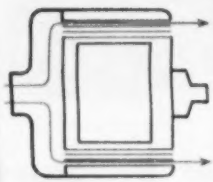
Your *Best* Motor Buy

for Outdoor Installations

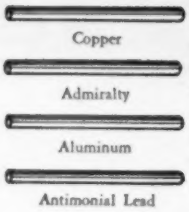
Here's Why

Practically Self-Cleaning



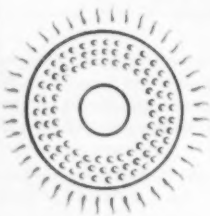
Air-to-air heat exchanger has straight, smooth tubes with no pockets in which dirt or moisture can collect. Velocity of cooling air through the tubes keeps surfaces swept clean. If sticky dirt should pile up, the tubes can be cleaned in a few seconds with a long handled brush.

Choice of Tube Materials



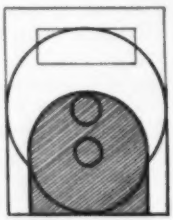
Allis-Chalmers tube-type motors can be built for service in corrosive atmospheres and for outdoor operation in almost any climate. Tubes may be made of a variety of materials, depending on service conditions.

Uniform Cooling



Tubes for carrying cooling air are distributed uniformly around the perimeter of the stator and along its full length. Result: heat travels over a short path and the interior is uniformly cooled.

Compact



Allis-Chalmers tube-type motors are little or no larger than open motors of the same rating. Tube-type design exposes large surface area to cooling air in minimum space.

Get Complete Information Now — Ask your Allis-Chalmers district office representative about tube-type, totally-enclosed fan-cooled motors in sizes up to 2000 hp. Or write Allis-Chalmers, Milwaukee 1, Wis., and ask for Bulletin 51B7150.

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5. Backed by Blackburn's reputation for quality and value.

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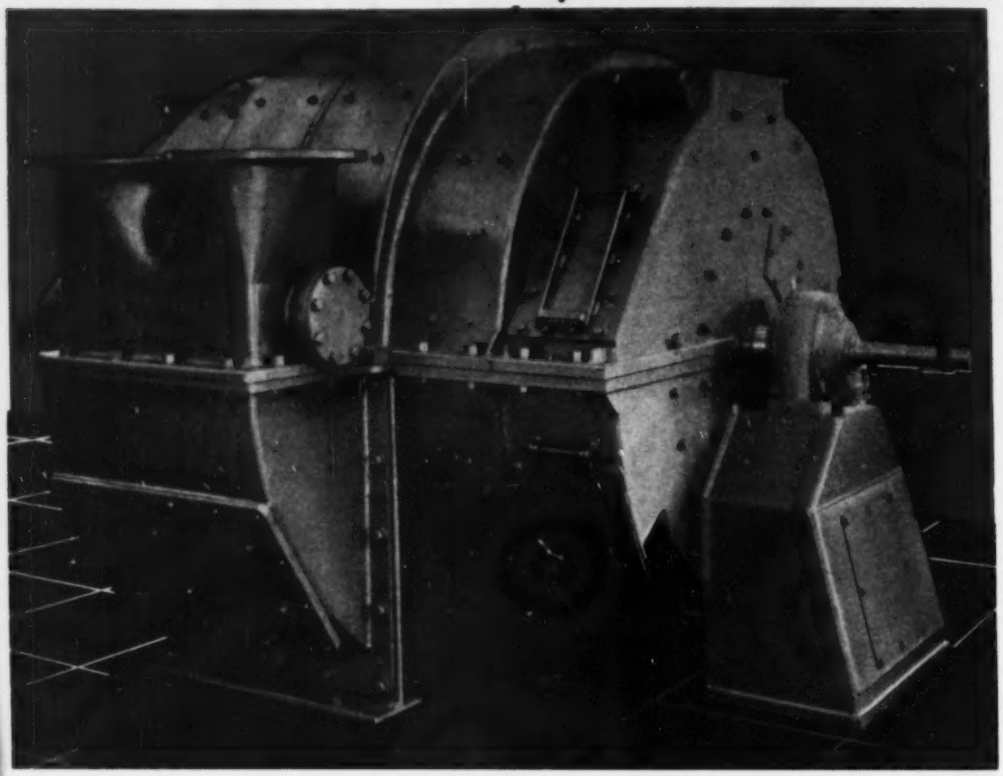
Performance of Riley "50" Pulverizers



Riley "50" Pulverizers give you all these other significant advantages . . .

- Quiet vibrationless operation
- Flexibility—wide load range
- Ability to carry extremely low loads
- Low power consumption
- Ease of regulation
- Small space required
- Minimum foundation cost
- Parts easily renewed
- Can be operated without coal feed
- Ease of ignition
- Low lubrication cost
- No worms or gears—Just two bearings
- High primary air temperatures
- Low maintenance

The Riley "50" Pulverizer is the latest development in the coal pulverizing field. It is the only pulverizer using tungsten carbide parts to assure long periods of continuous operation and low maintenance. It will pay you to investigate Riley "50" Pulverizers when considering this type of equipment.

RILEY

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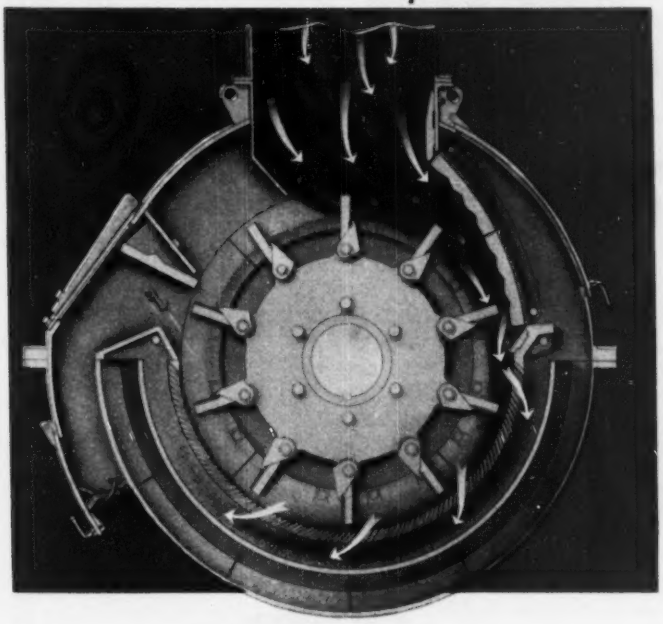


This Crusher-Dryer Stage Does the Trick

Both field and laboratory tests have conclusively proven that moisture content of coal does not affect performance of Riley "50" Pulverizers and that capacity is not decreased with an increase in moisture provided primary air temperatures are adequate. Coals with free moisture up to 15%, which is about the free moisture limit that coal can retain, have been satisfactorily pulverized.

The ability of Riley "50" Pulverizers to handle such high moisture coals without capacity reduction is due to the performance of the crusher-dryer section of the Riley "50" Pulverizer. In this first stage, the free moisture is evaporated and the coal crushed to a fine granular state so that coal passing to final pulverizing stage is free of surface moisture.

Ask users of Riley "50" Pulverizers—they will tell you that moisture of coal means nothing to their Riley "50" Pulverizers.

All of these people have ordered Riley "50" Pulverizers within the past two years.

PUBLIC UTILITIES

Detroit Edison Co.
Iowa-Illinois Gas & Electric Co.
Monongahela Power Co.
Utah Power & Light Co.
Hartford Electric Light Co.
Public Service Co. of Colorado
Iowa Electric Light & Power Co.
Northern States Power Co.
The Potomac Edison Co.
Superior Water, Light & Power Co.
Western Colorado Power Co.
South Carolina Public Service Authority
Corn Belt Power Cooperative
Central Ohio Light & Power Co.

MUNICIPAL PLANTS

City of Richmond, Indiana
City of Holyoke, Mass.
City of Rochester, Minn.
City of Owensboro, Ky.
City of Austin, Minn.

INDUSTRIAL COMPANIES

Carbide & Carbon Chemical Co.
Goodyear Tire & Rubber Co.
Western Electric Co.
General Electric Co.
Hooker Electrochemical Co.
North American Aviation
The Ohio Oil Co.
National Supply Co.
Continental Can Co.
Monsanto Chemical Co.
St. Croix Paper Co.
Celanese Corp. of America
Owens-Corning Fiberglas Co.
Pittsburgh Plate Glass Co.
Lawless Bros. Paper Co.
U. S. Finishing Co.
Bell Aircraft Co.
Syracuse University
U. S. Steel Company
Riegel Textile Corp.
White Pine Copper Co.
Ciba States Ltd.
Great Lakes Naval Training Station
Boston Navy Yard
Ashland Oil & Refining Co.
Ruberoid Co.

ENGINEERED BY THE FOLLOWING CONSULTANTS

Stone & Webster Engineering Corp.
Ebasco Services
Sargent & Lundy
Ford, Bacon & Davis, Inc.
Chas. T. Main, Inc.
Sanderson & Porter
United Engineers & Constructors
Jackson & Moreland
Bechtel Corporation
Pioneer Service & Engineering Co.
Black & Veatch
Stanley Engineering Co.
Douglas M. McBean
Robson & Woese, Inc.
Francisco & Jacobs
Burns & McDonald
Kenneth R. Warrington
J. V. Edeskuty
Robert S. Curl & Associates
Interboro Company
Catalytic Construction Co.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

CURTAINS for OXIDATION and DEPOSITS in turbine lubricating systems...

GULF'S famous ONE-TWO

FLUSH WITH GULF TURBINE FLUSHING OIL

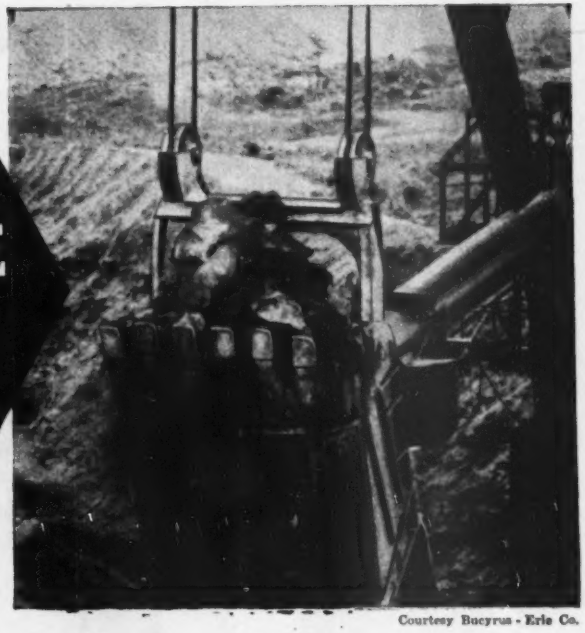
Removes grease-type slushing compounds. Carries away harmful abrasives. Protects against rust.

FILL WITH GULFCREST OIL

Maintains low neutralization number. Lasts indefinitely. Prevents rust on all oil-bathed surfaces.

Ask a Gulf Lubrication Engineer for additional information. Write, wire, or phone today. Gulf Oil Corporation · Gulf Refining Company, Pittsburgh 30, Pennsylvania.

PERFORMANCE HERE DEPENDS ON THIS



Courtesy Bucyrus - Erie Co.

A measure of a shovel's efficiency is the size of its bite. But of equal importance is the length of time the shovel will keep on biting. That is why the trailing cable that transmits power to the shovel should be as good as you can buy. Compared with the cost of the shovel or other material-handling equipment, the cost of the trailing cable is insignificant. Yet a breakdown in this cable can have a disastrous effect on your cost. Nothing but the best is good enough.

TIREX Cables are first-quality cables. They are engineered for tough, long-lasting service. Service records covering many years prove that they give the service expected of them.

Whether the service is on a slusher hoist, a cutting machine, a continuous miner, or a stripping shovel, there is a size and type of TIREX Cable to fit every job. Whenever you need a portable cord or cable specify and be sure that you get Simplex-TIREX Cords or Cables. There are none better made.

SIMPLEX TIREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS

POWER FAILURE PREVENTED!

—Thanks to the split-second action of a BLAW-KNOX FOG SYSTEM

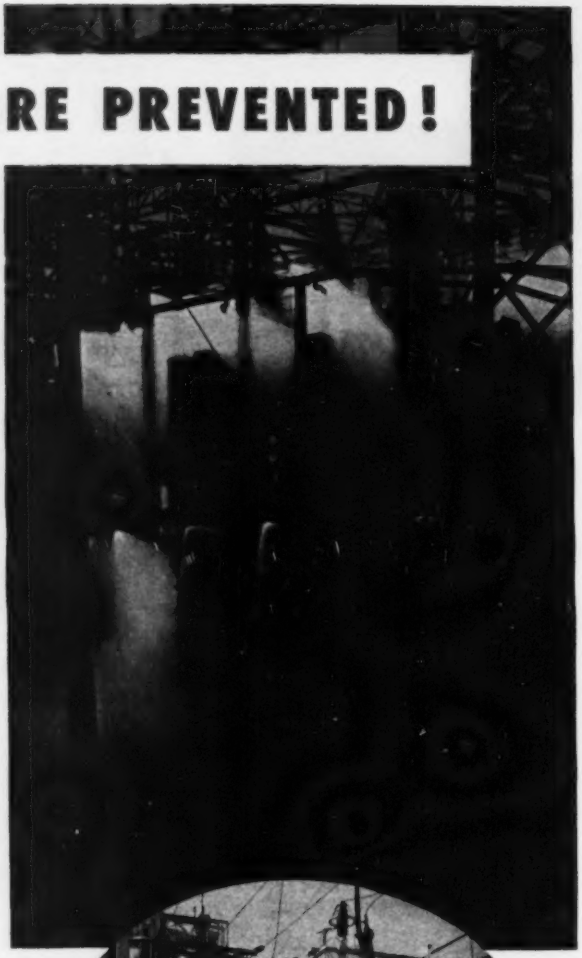
A transformer fire, no matter how small, can disrupt the 24-hour service now taken for granted of utilities. And, while financially unimportant, it may easily cause a blackout affecting defense industries, hospitals, homes and municipal properties. Don't you think it is your obligation to protect both your own property and customer good-will with the most efficient system for transformer protection?

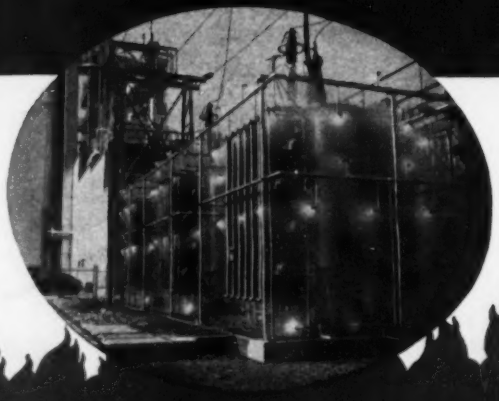
At your request a Blaw-Knox Engineer will survey your fire hazards, prepare a preliminary layout of the system that will give you the utmost in fire protection, and submit an estimate of costs—all without obligation.

BLAW-KNOX CONSTRUCTION COMPANY
POWER PIPING AND SPRINKLER DIVISION
829 Beaver Ave., N.S., Pittsburgh 33, Pa.

• • •

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.





"LITTLE JOEY SPRINKLER"
Always on the Job

BLAW-KNOX

AUTOMATIC FIRE PROTECTION SYSTEMS

NEW! EXCLUSIVE!
L-M's 7.5 KV "FAMILY"
of cutouts with interchangeable doors!

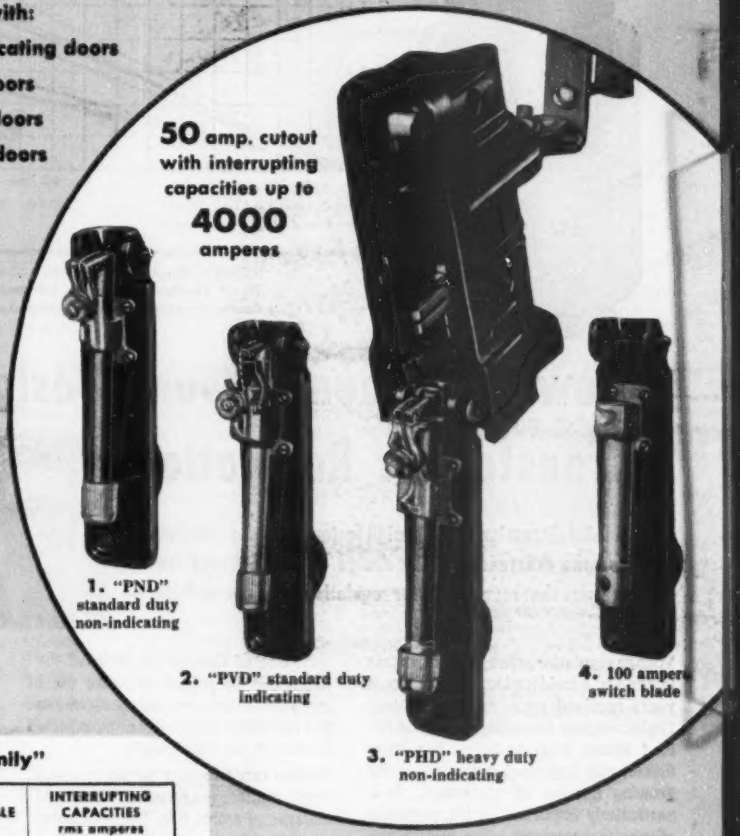
50 and 100 ampere cutouts, each with:
new "PND" standard duty non-indicating doors
"PVD"* standard duty indicating doors
"PHD" heavy duty non-indicating doors
100 and 200 ampere switch blade doors

Here's another L-M "first"! The new 7500-volt family of 50 and 100 ampere cutouts, each with four interchangeable doors to meet a wide variety of services. As operating requirements change, you simply change a door—in 6 seconds the job is done! Saves warehousing, saves installation time, saves in operation.

Safer, too. Doors are removed or hooked on, all with the switch stick. When door is open, all parts are dead.

GET THE WHOLE STORY

Ask the L-M Field Engineer for details on L-M's new "first families"—the 7500-volt family shown here, *and L-M's new 5000-volt family*, also! Or write Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).


50 amp. cutout with interrupting capacities up to 4000 amperes
1. "PND" standard duty non-indicating
2. "PVD" standard duty indicating
3. "PHD" heavy duty non-indicating
4. 100 ampere switch blade

L-M's new 7.5 kv "Family"

RATING	INTERCHANGEABLE DOORS AVAILABLE	INTERRUPTING CAPACITIES rms amperes
50 AMPERES	1. "PND" standard duty non-indicating	1200 amperes
	2. "PVD" standard duty indicating	1200
	3. "PHD" heavy duty non-indicating	4000
	4. Switch Blade — 100 amperes continuous current rating	
100 AMPERES	5. "PND" standard duty non-indicating	3000 amperes
	6. "PVD" standard duty indicating	3000
	7. "PHD" heavy duty non-indicating	8000*
	8. Switch Blade — 200 amperes continuous current rating	

"PND", "PVD", AND "PHD" are L-M Trademarks *Available soon

100 amp. cutout with interrupting capacities up to 8000 amperes

5. "PND" standard duty non-indicating
6. "PVD" standard duty indicating
7. "PHD" heavy duty non-indicating
8. 200 ampere switch blade

LINE MATERIAL
fuse cutouts

Complete Coordinated Equipment for Distribution Today

LET'S LOOK AT THE FACTS

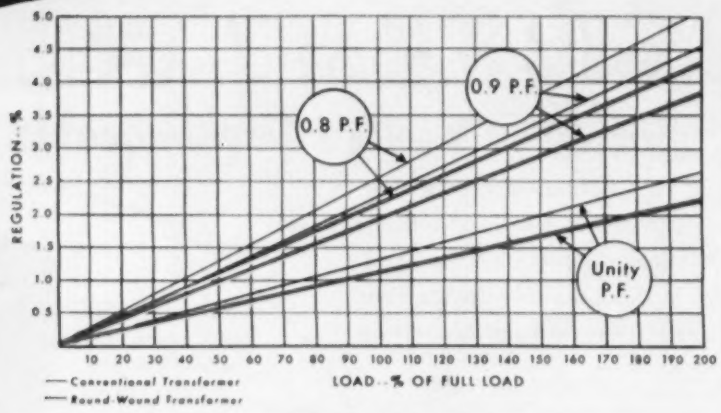


FIGURE 1—Regulation of a standard 50 kva 2400—120/240 volt Round-Wound transformer compared with that of a conventional transformer, showing the effect of load and power factor on regulation.

How L-M Round-Wound Design Improves Transformer Regulation

A brief discussion of the design factors affecting regulation, and the differences in the design of Round-Wound transformers that result in better regulation at all power factors.

By **JAMES G. EVERHART**
Chief Engineer,
Transformer Division,
Line Material Company

Voltage regulation, always an important factor for consideration, has in recent years received even more attention. Higher average secondary voltage at full load means brighter lights, less lamp flicker, and improved operation of the growing number of appliances. It is particularly important in the operation of television receivers, where low voltage produces far greater effect than is generally known by the public.

Higher voltage produces greater revenue to the utility company and, in these days of extremely close margins or actual operating losses, utility companies cannot afford to neglect any source of potential revenue.

State power commissions also have become factors in maintaining regulation. And with the higher average loading of transformers prevalent today, voltage regulation becomes a somewhat more pressing problem.

Use of Capacitors Helpful

Much can be gained from the use of capacitors to improve voltage conditions. But capacitors alone cannot be expected to solve the entire problem.

Neither can adequate primary voltage, ample transformer rating, or shorter secondaries of ample size. The transformer *itself* must be designed to provide good regulation.

Methods of Improving Regulation

Poor regulation in a transformer is largely the result of high impedance due to high reactance, and high copper loss. Often large mean-turn diameter is the cause of high copper loss and poor regulation. In general, most design improvements that will reduce copper loss will also contribute to improved regulation. The problem in transformer design is to achieve the desirable results without the sacrifice of other desirable performance characteristics.

Regulation also must be uniformly good over all power factors. Figure 1 indicates the effect of load on regulation, it being evident that the poorest regulation is obtained with combinations of high loads and low power factors.

Regulation with Round-Wound Design

A Round-Wound transformer basically consists of a wound core, with long round coils wound directly onto the annealed core. With the exclusive L-M method, the core is not cut or unwound in any way. This is not necessary since the coils are wound directly onto the core in an L-M designed winding machine. The construction is shown diagrammatically in Figure 2.

The design achieves a number of advantages—better cooling throughout the coils, with better overload capacity; lower exciting current; lower copper loss.

"Round-Wound" is a Line Material Co. trademark.

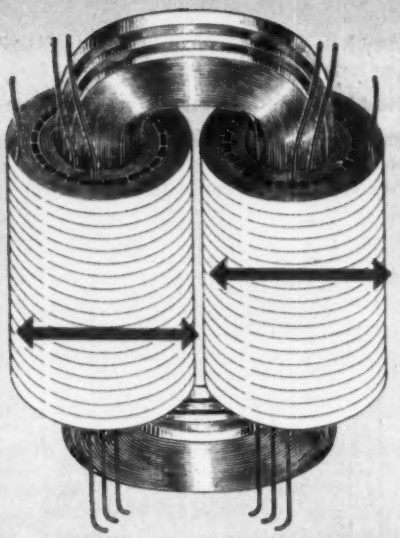


FIGURE 2—Round-Wound design. Long round coils are wound directly onto a wound core. Coils have low mean-turn diameter, a principal factor in the good regulation of Round-Wound transformers.

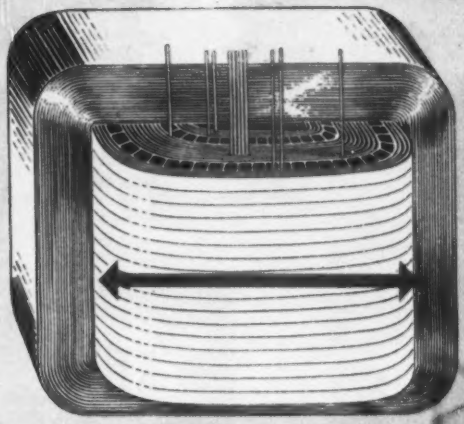


FIGURE 3—Shell type transformers generally have a much larger mean-turn diameter contributing to higher impedance, higher reactance, higher copper loss, which in turn results in poorer regulation.

The desirable smaller mean-turn diameter of the L-M coils is evident, by comparison of Figures 2 and 3 and examination of Figure 4. A higher efficiency core-coil arrangement also permits fewer winding turns. The combination of smaller turn diameter and fewer turns results in lower reactance and impedance, and in the desirable regulation indicated by Figure 1.

Thus the economy-minded power company can well take advantage of this Round-Wound design to secure, at one time, the savings offered by better regulation, lower losses, lower exciting current, and higher overload capacity.

Desirable Characteristics of L-M Round-Wound Transformers

Better Regulation: low resistance and reactance, providing low copper loss and better regulation, with more revenue to the utility and better service to customers.

High Short-Time Overload Capacity: long round coils and ample passages for oil circulation provide exceptionally good cooling with relatively low copper and hot-spot temperatures, permitting higher short-time overloads and higher load factors.

High Uniform Impulse Level: round coils are wound evenly, without hammering to shape; have longer creepage distance; ample insulation between layers and windings.

High Short-Circuit Strength: round coils have fundamentally superior strength characteristics, contributing greatly to the long life of Round-Wound transformers.

Low Exciting Current: because the wound core is not cut or disturbed, air gaps are not created in assembly, and exciting current is appreciably lower in this design.

Better Loss Ratios: the Round-Wound design makes possible an improved ratio of losses with lower total losses without sacrificing low exciting current.

For More Information

Ask the L-M Field Engineer for bulletin on L-M Round-Wound design, or write Mr. Everhart at Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

Round-Wound transformers are filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

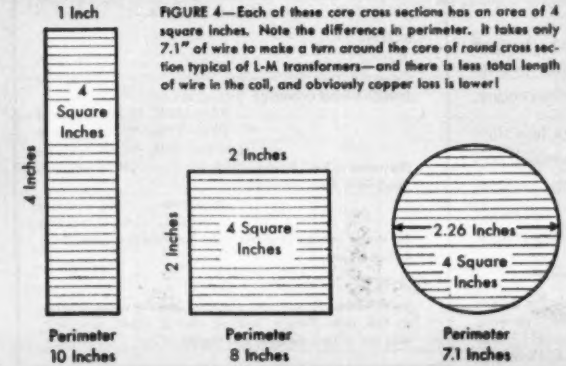
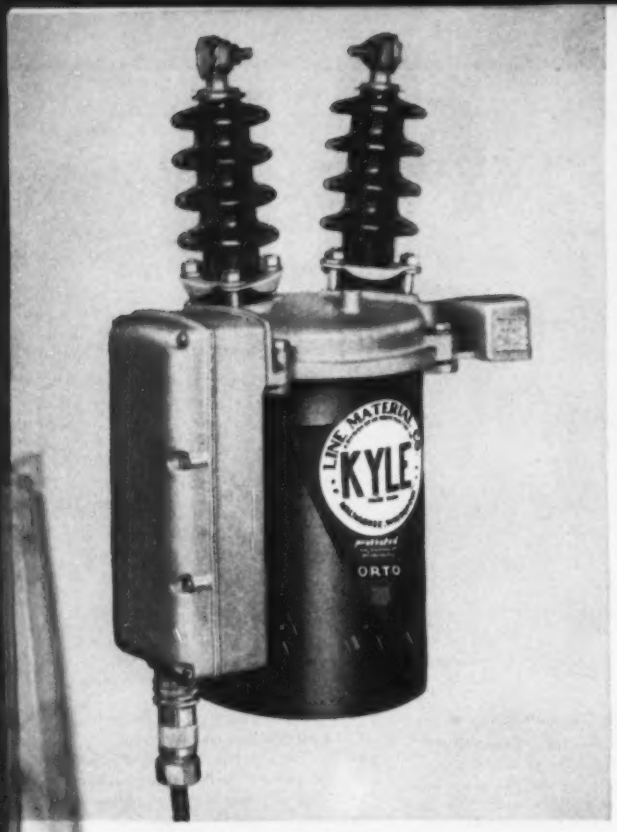


FIGURE 4—Each of these core cross sections has an area of 4 square inches. Note the difference in perimeter. It takes only 7.1" of wire to make a turn around the core of *round* cross section typical of L-M transformers—and there is less total length of wire in the coil, and obviously copper loss is lower!

LINE MATERIAL

Transformers

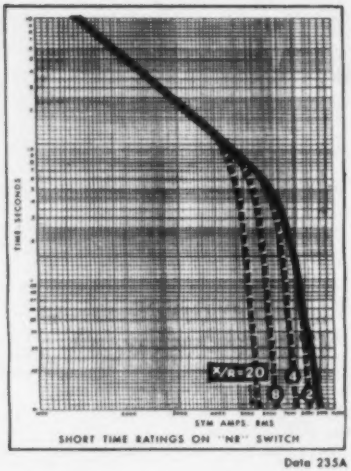
Complete Coordinated Equipment for Distribution Today



L-M's Kyle Type "NR" remote control oil switch—the same switch used in L-M's switched capacitor racks.

"Field-Designed"—with the features users asked for.

200-amperes nominal load rating at 14.4 kv, 150 amperes for capacitor switching. 9000 amperes RMS asymmetrical momentary current rating.



SHORT TIME RATINGS ON "NR" SWITCH

Data 235A

L-M Announces New Remote Control Oil Switch for Capacitor Switching

Here is L-M's new motor-operated 200-ampere remote control oil switch. It is specially designed for low-cost capacitor switching up to 3500 kvar 3-phase, but is equally suitable for street lighting, flood and airport lighting, protective lighting, sectionalizing, and other remote control switching applications. Ratings meet users' needs and requirements for capacitor switching and many other applications.

The contact structure is so designed that heavy currents increase contact pressure and give the switch high momentary and short-time current ratings. Spring-loaded contacts give very fast "make" and "break"—which eliminates restrikes and minimizes contact erosion when closing in on large capacitor banks.

The switch can be bolted directly to the pole, or crossarm with a thru-bolt or crossarm-mounted with a clamp-around hanger. Clips also available for mounting on substation steel structure.

Control motor requires less than one ampere at 120 volts, which permits the lightest wiring, simpler control circuit, and gives longer life for limit switches and relays.

Get Full Information

Ask the L-M Field Engineer for details on this new Type NR Switch—or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

Type "NR" Switch Ratings

SINGLE PHASE

VOLTAGE

Nominal	RMS 14.4 kv
Maximum design	RMS 15.0 kv
60 cycle, one minute withstand, dry	RMS 35.0 kv
60 cycle, ten-second withstand, wet	RMS 30.0 kv
1½ x 40 Ms impulse withstand, crest, BIL	95.0 kv

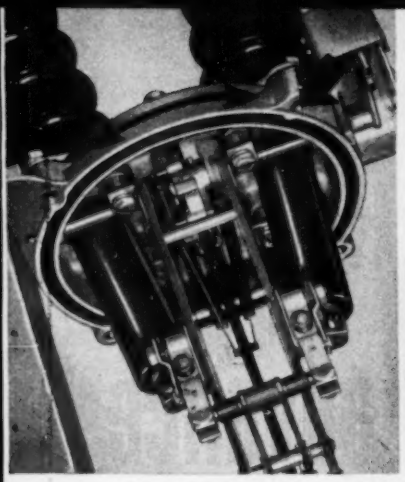
CURRENT

Thermal	200 amperes
Capacitor switching, nominal	150 amperes
Inductive load switching,	
75 to 100% PF	200 amperes
50 to 75% PF	100 amperes
Less than 50% PF	50 amperes
Momentary, RMS Asymmetrical	9000 amperes
Short-time, RMS Symmetrical	
10 seconds	1400 amperes
1 second	4500 amperes

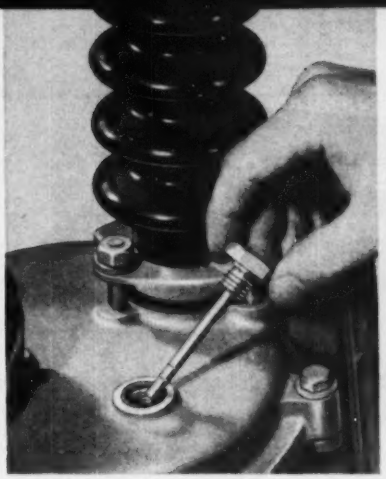
For larger ratings at shorter time intervals see curve, Data 235-A above.

CONTROL

Motor-operated actuator requires less than one ampere at 120 volts. Permits simplest control circuit and gives long life of limit switches and control relays.

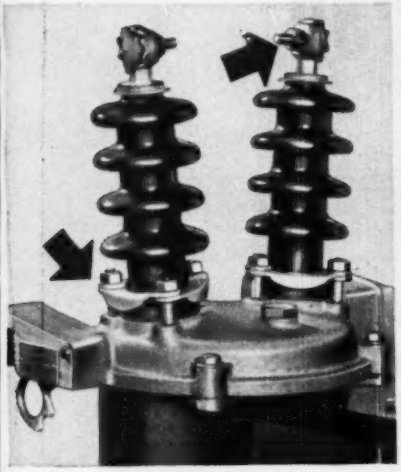


Head may be rotated and set at desired position. Lips in the groove on the underside of head hold the gasket so that it doesn't fall out when the cover is lifted.

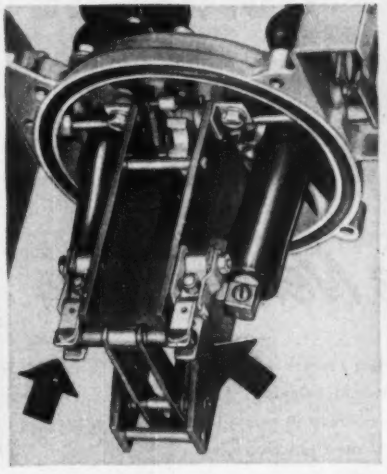


Oil dip stick on the head for checking the oil level. The tank holds 1½ gallons of oil. The inner mechanism is insulated from the tank by the oil and by a tank liner.

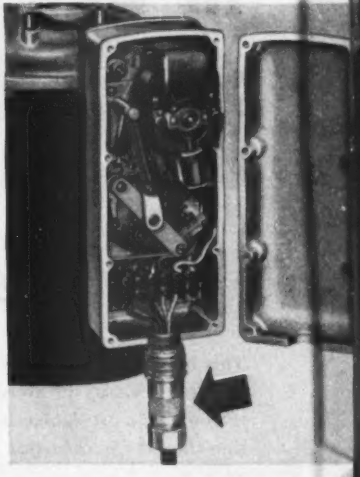
Heavy bracket for direct mounting to pole or crossarm with or without a hanger. Heavy tank, with inserted concave bottom, so that only the rim takes abrasion.



The bushings are the clamp-on type which make replacement easy. Bushings are oil-filled for lowest radio noise level. Plated Universal terminals for aluminum or copper conductor, No. 8 to 2/0.



Contacts arranged so heavy currents increase contact pressure, giving high momentary and short time current ratings. Spring-loaded contacts give quick make and break to prevent restrikes and minimize erosion.



Motor-operated actuator requires less than one ampere at 120 volts, permitting lighter wiring and simplest control circuit, and assuring long life for limit switches and relays. Weatherproof plug-in connection at bottom of box and weatherproof plug available.

CAPACITOR SWITCHING RATING

Voltage	Based on 25 KVAR Units				Based on 15 KVAR Units			
	Three-Phase		Single-Phase		Three-Phase		Single-Phase	
	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units
2400	600	24	350	14	585	39	360	24
4160	1050	42	625	25	1080	72	615	41
4800	1200	48	725	29	1215	81	720	48
7200	1800	72	1075	43	1845	123	1080	72
12470	3225	129	1850	74	3240	216	1860	124
13200	3375	135	1975	79	3420	228	1980	132
13800	3525	141	2050	82	3555	237	2070	138

LINE MATERIAL

Kyle® Oil Switches

Like all Kyle reclosers, the Type NR switch is filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

Another Westinghouse Relay Development

Here's the greatest advance in Basic Relay Design in Half a Century!

The New CO Relay

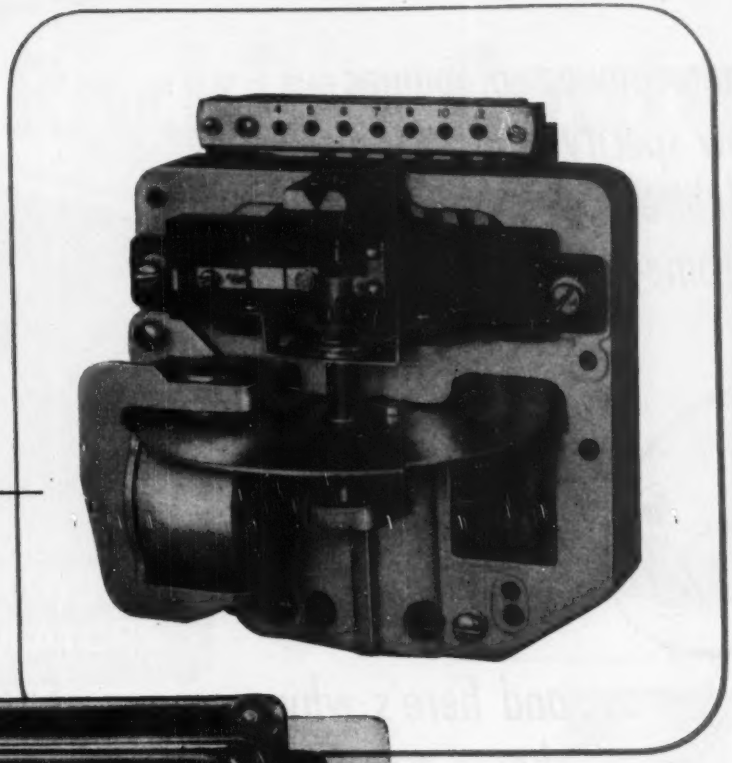
This new CO Relay brings you remarkable, new operating benefits in overcurrent relaying. The reason—the most significant advance in relay design since the introduction of the induction disc relay! We call it simply the "E" element—but look how it contributes to superior relay performance.

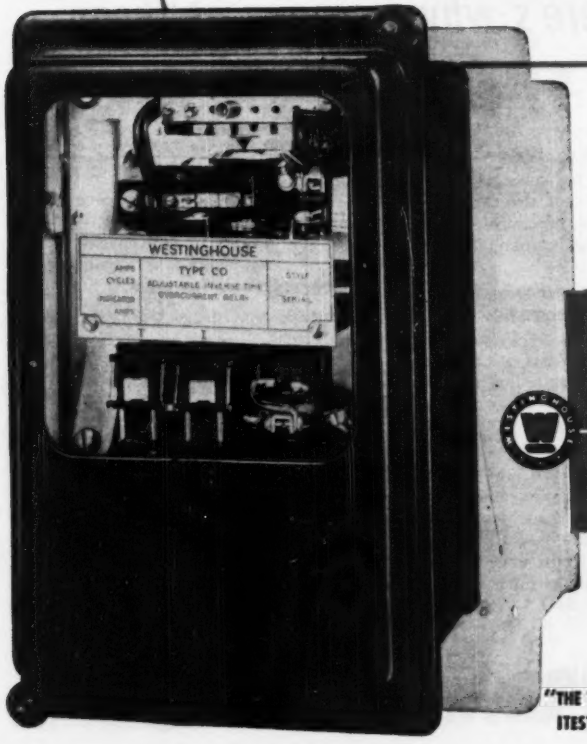
FOR GREATER ACCURACY . . . Magnetic plugs control the saturation characteristics to provide accurate timing over the entire operating range. Two independent adjustments provide accurate pickup at tap value of current for all disc positions. Micrometer adjustment of permanent magnet, by means of a "keeper" screw, which provides accurate adjustment without moving the magnet. Thus, four separate and independent tolerance controls, instead of only two as found on earlier relays, assure you of meeting time curves without compromise.

FOR GREATER FLEXIBILITY . . . A "Two-in-one time curve." Inverse and very inverse relays are identical except for calibration and, therefore, may be changed from one curve to the other (or intermediate curve).

FOR GREATER RELIABILITY . . . New positive-action tap block with "self-positioning" taps give metal-to-metal contact between tap terminal and tap plate. Other features contributing to reliable relay protection include: rigid one-piece, die-cast frame—cast alnico magnet—and non-geared design.

Ask your Westinghouse Representative to show you the new CO Relay—he'll be glad to go over it feature by feature with you—or request a demonstration by writing to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40410





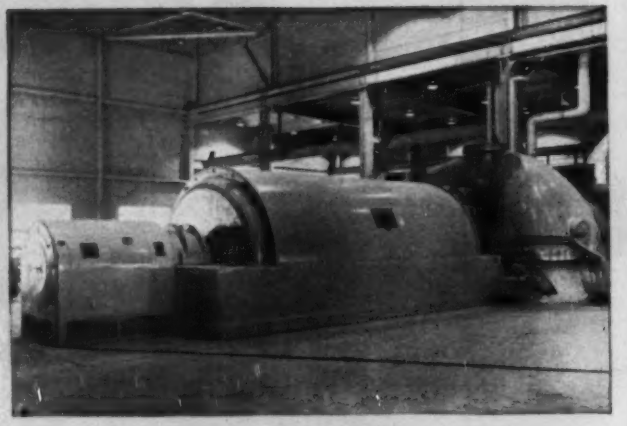
YOU CAN BE SURE ... IF IT'S

Westinghouse

RELAYS

"THE TYPE CO OVERCURRENT RELAY IS AVAILBLE IN FLEX-ITEST OR STANDARD RECTANGULAR PROJECTION CASE."

"Major power companies now specify inhibited turbine oils"



. . . and here's why so many of them choose SHELL TURBO OIL

Shell Turbo Oil exceeds every accepted specification for premium turbine lubricants. These are the notable qualities:

1. HIGHEST ATTAINABLE RUST PROTECTION

An effective combination of rust inhibiting additives goes to work at the source of rust formation. Rust problems are reduced to the very lowest level.

2. COMPLETE OXIDATION STABILITY

The anti-oxidant in Shell Turbo Oil has so far defied improvement! It provides outstanding oxidation stability and thereby minimizes sludge formation.

3. ANTI-FOAMING

The anti-foam agent used is so effective that air entrainment can be tolerated for considerable periods—avoiding unscheduled shutdowns.

4. EXCELLENT EMULSION CHARACTERISTICS

Shell Turbo Oil's remarkable protection against rust and oxidation is attained with the minimum tendency to formation of water emulsions in service.

5. PROTECTION AGAINST WEAR

The inhibitive agents in Shell Turbo Oil add to the wear-reducing qualities of the specially refined oil itself, an extra margin of safety for the bearings during critical starting periods.

We'll be glad to give you the full story on Shell Turbo Oil, with specific recommendations for your own generating units.

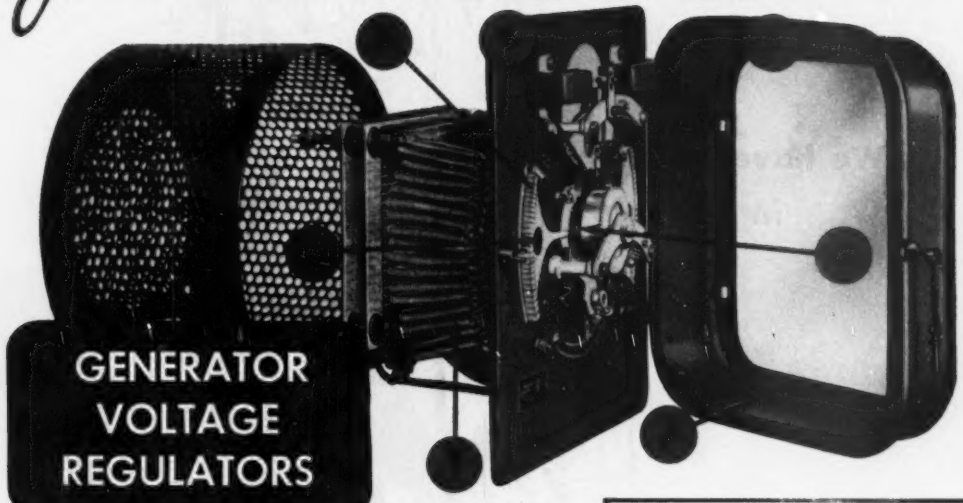
SHELL OIL COMPANY

50 West 50th Street,
New York 20, New York,
or 100 Bush Street,
San Francisco 6, California.

SHELL

SHELL TURBO OIL

Get Rocking Contact



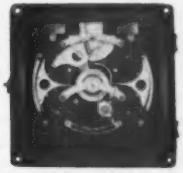
GENERATOR VOLTAGE REGULATORS

With these 7 Features:

- **RESISTORS** are matched to the characteristics of your machine . . . are cut in and out of the exciter shunt field by the *Rocking Contact* sector.
- **SECTOR RIM,** of hard graphite, rocks on the silver-surfaced commutator. This eliminates contact build-up without polarity reversing circuits.
- **COMMUTATOR** is curved so that small sector movement gives quick response.
- **MOTIVE ELEMENT** driving contact sector is fast acting—because of its low inertia design.
- **DAMPING MECHANISM** has no electrical circuits . . . is self-contained.
- **JEWELED BEARINGS** reduce friction, improve sensitivity.
- **DUST-TIGHT COVER** seals out dirt . . . assures lasting accuracy.

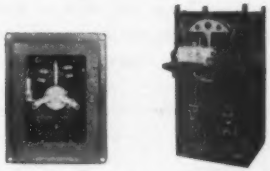
Designed for panel mounting, every *Rocking Contact* Regulator has an instrument-like appearance. Select the one that fits your needs. For further information, call your A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3762

Rocking Contact is an Allis-Chalmers trademark.



TYPES A, B, and C (shown in detail above) are applied to ac generators from 125 kva at 257 rpm to 25,000 kva at 3600 rpm. Get Bulletin 1486035.

TYPES V-00 and 221 Regulators are applied to ac generators from the smallest up to 438 kva at 3600 rpm. Bulletin 1486143A describes them.



TYPE J, for larger machines, consists of two parts: motor-operated *Rocking Contact* rheostat and a panel-mounted control element. Bulletin 1486015.

ALLIS-CHALMERS

We have an army in the field

BELL SYSTEM communications for the powerline industry are guarded constantly by an army of trained specialists in the field. That's one of the big advantages in using Bell System communication services. This army is on the job to keep your service in operation 24 hours a day, 365 days a year.

The knowledge and skill of these and other Bell System technicians are the result of more than 75 years of experience in communications — experience that will give you good, dependable, economical communications for all of your needs.

We provide — by radio, wire or cable — a wide variety of services. They include private-line telephone, mobile telephone, and teletypewriter services, and channels for remote metering, supervisory control, facsimile and other signaling.

Your Bell Telephone Company will be glad to study your communications problems and needs without charge.

PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM

CONSULT G&W FOR CABLE BOXES

Practical and economical standard and special designs for splicing, interconnecting or sectionalizing cables with solid, bolted, link or fuse connections.

CABLE BOXES

Underground cable boxes are an important item in an electrical distribution system. They establish the desirable control over the duration and the extent of service interruptions. The ideal system is one which provides maximum continuity of service at minimum overall cost. The increased use of electric light and power makes it extremely difficult to arrange for even brief outages for necessary system changes and additions. Sectionalizing boxes permit circuit detours without dropping important loads. Fuse boxes minimize the extent of cable trouble. Distribution boxes provide for proper system maintenance with the least service interruptions.

No. 8523

G & W Electric Specialty Co.
7780 Dante Ave., Chicago 19, Ill. Date_____

Please send me a copy of new Bulletin BA52 on CABLE BOXES—

Name_____ Title_____

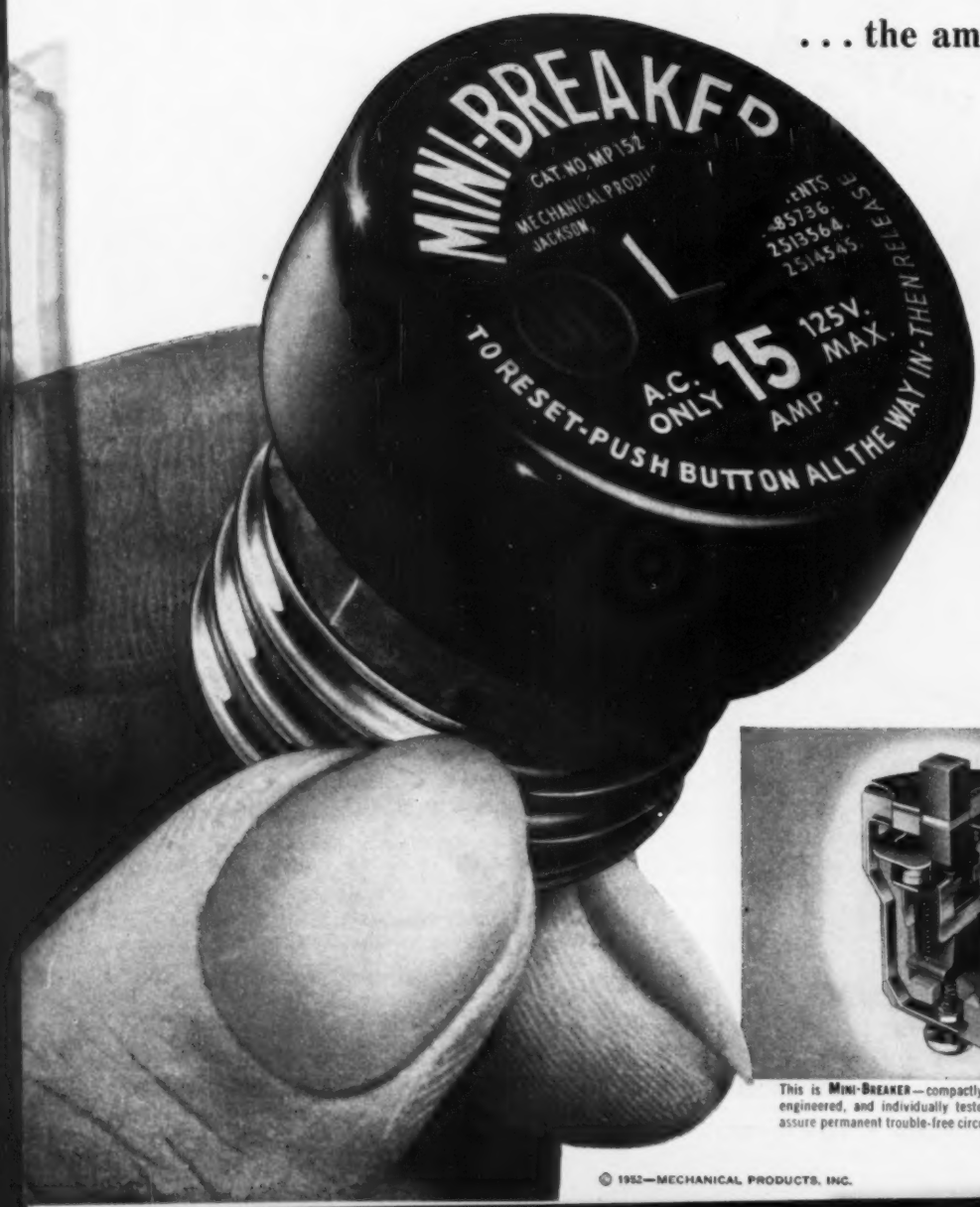
Company_____

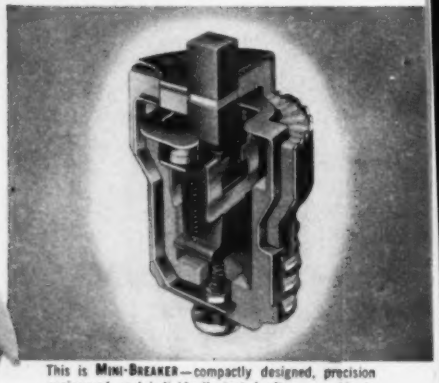
Number, Street or P.O. Box_____

City_____ Zone____ State_____

Introducing MINI

. . . the amazing





This is **MINI-BREAKER**—compactly designed, precision engineered, and individually tested after assembly to assure permanent trouble-free circuit breaker protection!

© 1952—MECHANICAL PRODUCTS, INC.

-BREAKER®

new miniature circuit breaker that fits like a fuse in any standard plug-type fuseholder!

Anyone can install a MINI-BREAKER in seconds! And anyone can restore electrical service simply by pressing and releasing the reset button!

NEVER before has there been a circuit protective device quite like the amazing new MINI-BREAKER. Because here, for the first time, is a *thoroughly tested* miniature branch circuit breaker that can actually be used as a *direct replacement* for expendable plug-type fuses! Installed by anyone in a matter of seconds in any standard Edison base fuse receptacle. Used with confidence, too, wherever 15, 20 and 30 ampere circuits exist for 110-125 volt a-c service. For although many attempts have been made to develop just such a practical low-cost device, MINI-BREAKER is the first and only product of its kind ever to meet the requirements specified for listing as a "Circuit Breaker-Miscellaneous" by Underwriters' Laboratories, Inc. And, when commercially available, it will bear the Re-examination Service marker.

Provides Permanent, Positive Protection Against Overloads and Short Circuits!

Yes, in spite of its compact size and its basic resemblance to the fuse it is designed to replace, MINI-BREAKER is a full-fledged circuit breaker in every sense of the term. A precision built assembly of carefully selected, perfectly balanced parts . . . all permanently protected and enclosed within a durable insulating case.

In operation, MINI-BREAKER safely interrupts excessive overloads and short circuits . . . tripping instantly on "shorts", but with a built-in time lag for handling temporary starting loads and line surges. Whenever an interruption occurs, service can easily be restored by anyone . . . normally within 10 seconds . . . simply by pressing in and releasing the reset button. Yet, in spite of its quick recovery, MINI-BREAKER is 100% trip-free. That is, it positively will not maintain a circuit that has not been cleared of the condition that caused the interruption.

What's more, while MINI-BREAKER is a thermally actuated breaker, it's virtually uneffected by the changes in ambient temperatures encountered under normal installation conditions. Because, although designed exclusively for ordinary residential, commercial, and industrial service, MINI-BREAKER actually meets and exceeds the temperature extreme conditions required for approval for aircraft use. MINI-BREAKER trips at 200% load within four minutes at −50°F., carries rated current continuously at 135°F.!

What can MINI-BREAKER *do for an Electric Utility?* Plenty! Just count the number of fuse-protected circuits on your lines today. Add the needless cost and inconvenience . . . to you or your customers . . . in replacing blown out fuses. Then project the increased revenue that would result if all those customers were to convert all those circuits to permanent, low-cost MINI-BREAKER installations! A worthwhile project, you'll agree. And we're ready to help you start it . . . *NOW!*

MECHANICAL PRODUCTS, INC.

1824 River Street • P. O. Box 116 • Jackson, Michigan

Want More Information on MINI-BREAKER?
Regardless of what your interests may be, we'd like to tell you more about MINI-BREAKER. A request on your company letterhead . . . or the coupon below . . . will bring you complete details by return mail.

MECHANICAL PRODUCTS, INC.—Dept. 101
1824 River Street • P. O. Box 116 • Jackson, Michigan

Gentlemen:
Please send me the complete MINI-BREAKER story at once!

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Sangamo J Meters

preferred by men who work with meters

Your meter superintendent and his men prefer meters that can be quickly and easily calibrated, saving costly man-hours for his company.

Men who work with meters *know*, that Sangamo J Meters, as received, seldom need any calibration to meet all generally accepted standards of accuracy.

Simple full-load and light-load adjustments—readily accessible from the front, exceptionally clear visibility, and easy removal of registers, are a few of the reasons why J Meters are favorites with meter testers everywhere! They're faster to test—easier to calibrate. An ordinary screwdriver is the only tool needed.

Economical replacement of parts is another of the reasons why the men who work with meters prefer J Meters. When advantageous, either the current or potential element may be replaced separately.

Only Measured Facts are Known Facts

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Sangamo J Meters have proved their ability to meet today's requirements and tomorrow's anticipated loads with sustained accuracy, economy of maintenance and troublefree performance.

designed to save manpower and reduce upkeep costs

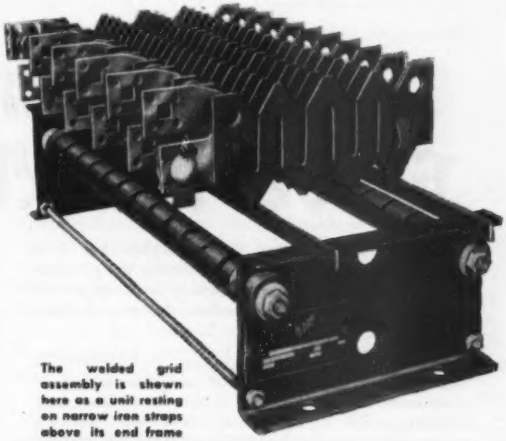
The welded GRID-ASSEMBLY steps up resistor-performance these 3 ways:

1- STABILIZES the ohmic value, independent of the clamping-nuts.

2-STOPS BURNING at grid-eyes and at tap-plates.

3-SIMPLIFIES tap-shifting, when adjusting resistance for best motor operation—also makes it easier to replace sections.

For reduced maintenance where maintenance can be easily overlooked, switch to EC&M Tab-Weld PLATE RESISTORS.

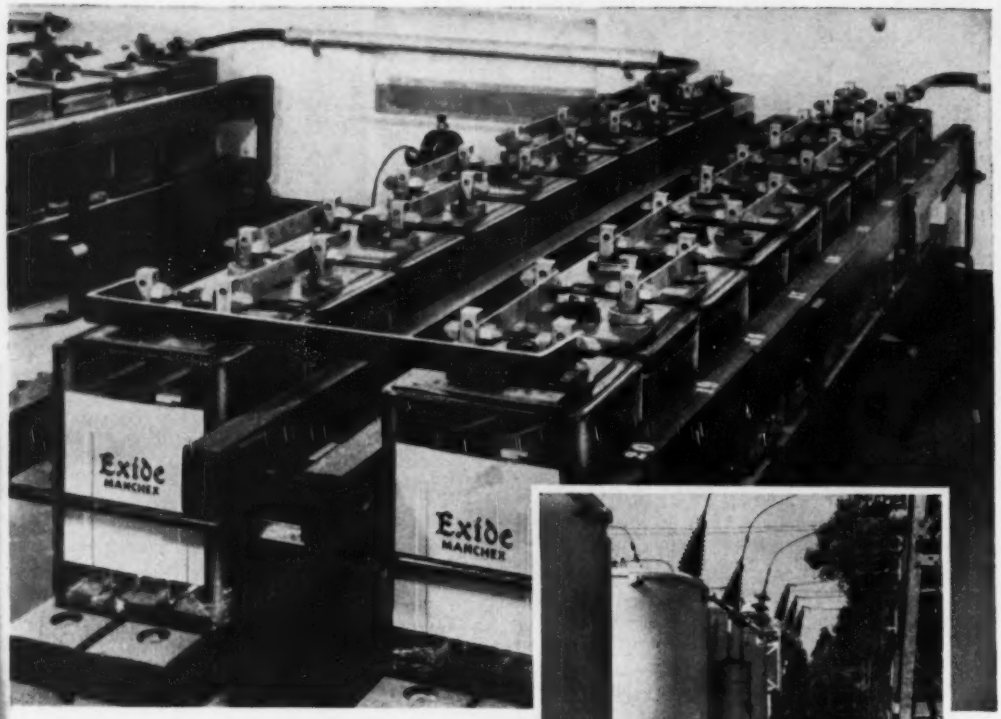


The welded grid assembly is shown here as a unit resting on narrow iron straps above its end frame support rods, and spacers.

SPECIFY BULLETIN 942 EC&M TAB-WELD RESISTORS

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET ★ CLEVELAND 4, OHIO



60-cell Exide-Manchex Battery, type DME-17 mounted on rack built to withstand earthquakes.

Modern, efficient substation of a Southern California utility company.

ON SWITCHGEAR DUTY IN SOUTHERN CALIFORNIA

Exide-Manchex BATTERIES

The modern equipment in this substation of a Southern California utility, highlights the progressive development of a State which ranks second in kilowatt capacity and number of users of electric power.

The substation shown is supplied at 66,000 volts and delivers 11,000 and 4,000 to urban and rural customers within the area it serves. Closing and tripping power for the station's oil circuit breakers is provided by Exide-Manchex Batteries... first choice of more and more stations, because in Exide-Manchex you get:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution needed during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

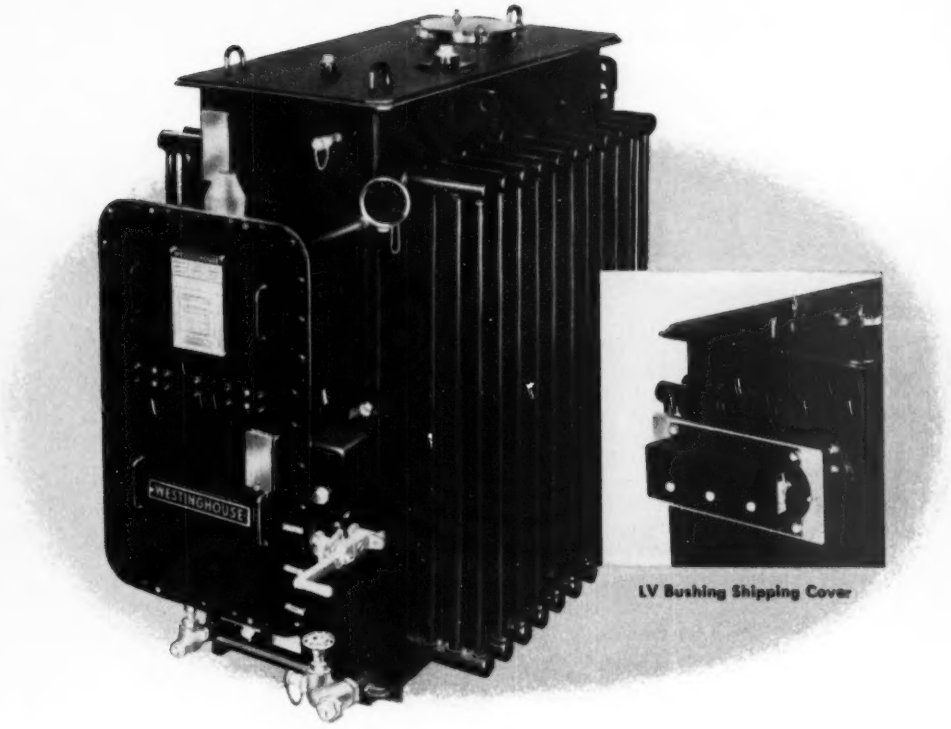
These features combine to make Exide *your best battery buy* for all control and substation services.

• • •

Various sizes and types of Exide Batteries, up to 100 ampere hours capacity, are available in plastic containers.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto
"Exide" and "Manchex" *Reg. T.M., U.S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952



LV Bushing Shipping Cover

QUALITY in the transformer ADDS RELIABILITY to the network

Everyone agrees that when you install a network system, you install *the best* for reliability and service continuity.

But the degree of reliability...or, more exactly, the freedom from maintenance, depends directly on quality in the transformers.

That's why Westinghouse Network Transformers have continuously wound coils of sliverless copper, to guard against hot spots, crystallization and pricked or scored insulation. That's why they're high-frequency tested, too.

In addition, Westinghouse Transformers are filled under vacuum, and have welded-on covers to assure a perfect seal. Finishes are not only baked for longer life, but bases are undercoated.

There are many other features such as the LV bushing shipping cover, shown above, that assure safe delivery of the quality built into Westinghouse Network Transformers. Your Westinghouse representative will be glad to give you full information, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70646

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK TRANSFORMERS

NETWORK SYSTEMS PAY... IN *NEW YORK STATE!*

BINGHAMTON converted from an overhead to an underground (radial) system in 1921. Change-over to network was accomplished between 1940 and 1945 without disrupting existing service. Load on the original network area was approximately 3,600 kva. By 1951, normal growth and some expansion of the area served had increased the network load to 6,000 kva. Further load growth, currently running 8-10%, will bring the load to 7,200 kva by 1954.

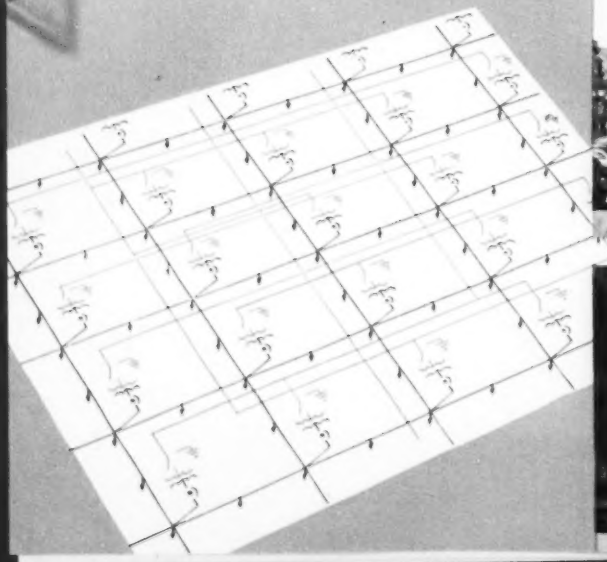
ELMIRA'S network is now in operation and the 1,300-kva load, including heavy air conditioning, is growing rapidly. A 10% increase in this load is expected by the end of 1952.

AUBURN'S network will be complete by 1953. Initial load will be approximately 2,500 kva and rate of growth is estimated at 5 or 6% per year. Serious voltage problems will be corrected by this installation.

LOCKPORT'S underground network will be complete in 1952 with a load of 1,500 kva. Congestion of overhead system and lack of room for expansion dictated an underground network.

BINGHAMTON, NEW YORK

ELMIRA, NEW YORK



AUBURN, NEW YORK

LOCKPORT, NEW YORK

4 more cases where networks met growth problems

New York State Electric & Gas Corporation serves an area embracing about 35% of New York state, covering 16,700 square miles in 43 counties. This is the home of some 1,400,000 people, and a widely diversified group of industries. To keep ahead of the actual electrical needs of this rapidly growing area requires constant and careful planning.

NETWORK PLANNING STARTED IN 1939 . . . this utility was faced with numerous interruptions caused by cable burn-offs, and unbalanced voltage and current conditions in the secondary distribution system. To correct these conditions, and at the same time prepare for sizable load growth, the A-C Secondary Network offered the most flexible, economical, long-range solution.

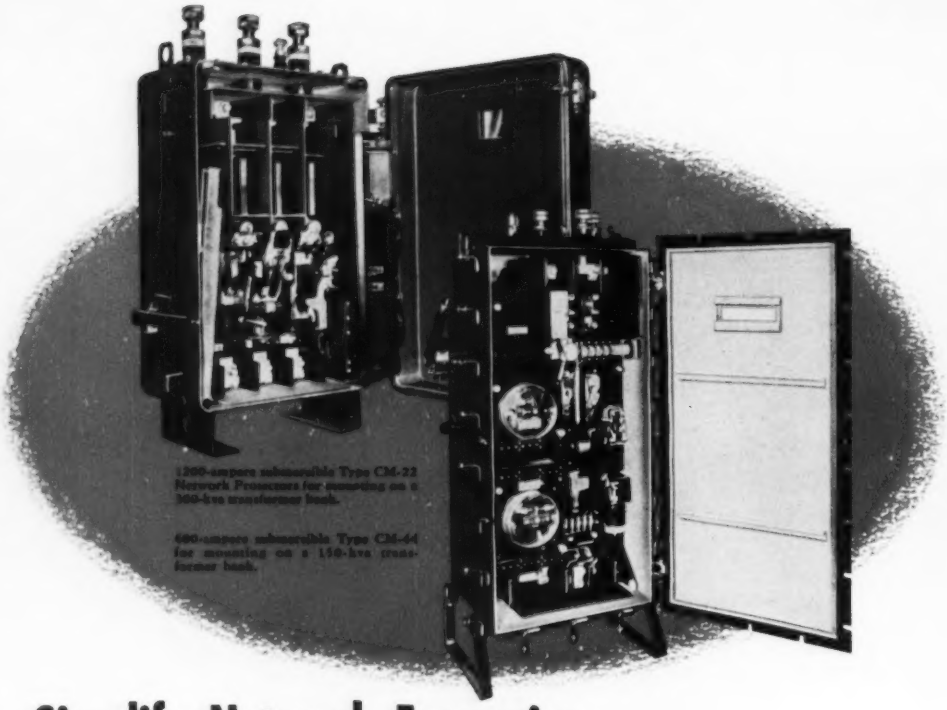
TODAY, New York State Electric & Gas Corporation measures the effectiveness of its A-C Secondary Network installations in ability to handle greatly increased load with improved reliability and quality of service. At the same time, the networks have eliminated duplicate services, separate substations previously required, and have materially reduced maintenance expense. They enjoy interchangeability of uniform equipment, too. Since the first network installation in Binghamton, others have been added in Elmira, Auburn, Lockport; and still other cities in the system are now being considered for network service.

THE RANGE OF WESTINGHOUSE NETWORK EQUIPMENT enables you to employ the type of system best suited to your local problems. Booklet B-4002 contains complete information about the flexibility and advantages of the A-C Secondary Network System. Our system planning facilities are at your service. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-97166

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK EQUIPMENT



1200-ampere submersible Type CM-22 Network Protectors for mounting on a 300-kva transformer bank.

600-ampere submersible Type CM-44 for mounting on a 150-kva transformer bank.

Simplify Network Expansion with Westinghouse NETWORK PROTECTORS

You can expand your network system simply—and economically—with Westinghouse Network Protectors. The reason—Westinghouse heavy-duty and medium-duty protector use the same relays. Hence, as load grows medium-duty (CM-44) protectors can be replaced with heavy-duty (CM-22) protectors and suitable transformers—*without upsetting system co-ordination!* CM-44 units may then be moved to lighter load areas.

Keep this important Westinghouse feature in mind as YOU plan your network system. It's a *sure* way to provide for simple, low-cost expansion of that system when load conditions dictate.

Ask your Westinghouse representative for further information . . . or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-60778

ONLY WESTINGHOUSE NETWORK RELAYS . . .

- Eliminate gears that cause friction and wear.
- Have a sensitive reverse-current setting that can be varied from .1% to 10% of the network protector rating.
- Have bearing surfaces readily accessible for inspection and cleaning.
- Have relay terminal screws that eliminate the need for additional testing facilities in the control wiring.
- Provide a nonsensitive relay that permits sensitive tripping after a time-delay.

YOU CAN BE SURE . . . IF IT'S

Westinghouse

NETWORK PROTECTORS

Built to Last...

P-L

4-WAY ANCHOR

Heavier — Stronger — Easier To Install

Built to Last... with heavy gauge steel used throughout. Deeply embossed and ribbed to withstand heavy loads without buckling.

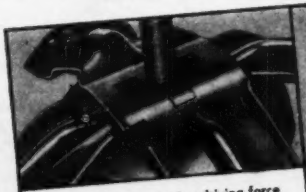
Built to Last... because blades are correctly aligned with grain of steel to prevent tearing and breaking, absolute necessity for anchor strength.

Easier to Install... because properly curved blades glide smoothly and easily into solid, undisturbed earth.

PL52-6

Available in 8" diameter with 100, 113 and 135 square inch expanded area. 2-Way Anchor also available in 6" and 8" diameter with 58 square inch to 138 square inch expanded areas.

Also Heavy Duty 4-Way Anchors in 10" diameter with 200 square inch expanded area. Designed for use on power transmission and heavy distribution lines.



Double thick metal takes driving force of tamping bar. Extra width of blade at hinge point, plus proper grain alignment, prevent breaking or buckling.

Shaped blades give greater holding power because they penetrate solid earth without loosening it. Blades deeply ribbed for extra strength.

Base plate formed from heavy boiler plate, embossed and flanged for added rigidity and strength.

PIEPER P-L LILLARD, INC.

TELEPHONE TERRYHILL 3-3525 — 122 N. KIRKWOOD RD. • ST. LOUIS 22, MO.

ORIGINATORS OF THE BENDING HINGE ANCHOR

WE *Did* SOMETHING ABOUT THE WEATHER!

Look for the light yellow coating — inside and out. Easy bending, non-flaking Triangle hot-dip galvanized conduit is also supplied with end-caps for protection of threads during shipping and handling.

-And Eliminated a Number of Headaches for You

Conduit is often subjected to external conditions—rain, snow and sleet, for instance, which cause rust despite the best hot-dip galvanizing.

Triangle engineers long ago solved this problem with a revolutionary lacquer-like coating on the inside and outside of our hot-dip galvanized conduit. Slightly yellow in color, this hard, tough coating—along with the hot-dip galvanized finish—prevents water, salt, chemicals and other elements from reaching the metal. It prevents the formation of rust or corrosion and acts as a primer or base—coat for future maintenance painting. It also helps prevent flaking when the conduit is being bent.

This special analysis coating is standard on *all* Triangle Conduit.

Obviously, Triangle conduit with this remarkable coating not only protects the conduit during shipping, storage and handling, but also makes the conduit *last longer* in service.

If rust or corrosion or any adverse condition is a problem for you, it will pay you to specify Triangle conduit. Ask your distributor!

The Trade Mark of **TOP** Quality

TRIANGLE CONDUIT & CABLE CO. Inc.

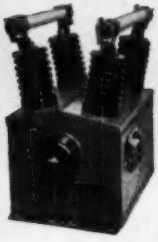
New Brunswick, New Jersey

"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Control Wire • Armored Cable • Service Entrance, Service Drop Cables • Varnished Cambric, Braided or Leaded • Trioprene Trench, Power & Parkway Cables • Bare Wire • Rigid Conduit Hot-Dipped Galvanized & Black Enameled • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit.

ALLIS-CHALMERS
INSTRUMENT
TRANSFORMERS

Outdoor current transformer for heavy duty metering, Type KO. Ratings up to 15 kv and 800 amperes.

Outdoor potential transformer, 200 va, Type PWD. Ratings up to 15 kv.



Indoor potential transformer, 200 va, fused or unfused, Type PD. Ratings up to 14,400 volts.

Safety Factor *stepped up!*

BECAUSE OF THIS VACUUM-PRESSURE PROCESS

THE SPECIAL CHAMBER shown above houses a modern vacuum-pressure system for compound-filling Allis-Chalmers instrument transformers. Here the core-and-coil assemblies and compound become a compact unit—with all parts positively positioned for life. And because air and moisture are kept out permanently, insulation strength is retained almost indefinitely.

Here's How It Works

When the door is closed on the core and coil assemblies (preheated before they are placed inside), a combination of high vacuum and Sahara-like heat whisks away all moisture and entrapped air. Soon the assembly is bone dry. Then hot liquid compound—from which air and moisture are removed—is directed into the transformer case. When case is full, vacuum is released. The hot compound is forced into the innermost recesses of the tanked assembly, completely filling all voids. The transformer is then removed to another area for cooling and final finishing.

You Get 4 Big Benefits

The Allis-Chalmers method of compound-impregnating results in a higher safety factor for your instrument transformer . . . giving you these four advantages:

1. High dielectric strength
2. Air and moisture cannot attack insulation
3. Eliminates maintenance of an insulating medium
4. No leakage or contamination

The extra benefits resulting from this compound-impregnating process can save you money. Why not contact your nearby Allis-Chalmers district office today for more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A 3742

ALLIS-CHALMERS

forget about **this**

DURALINE* provides added assurance against power outages caused by moisture, whether in the form of rain or sleet or snow. Duraline won't festoon, is more resistant to damage by foreign objects.

install Duraline . . .

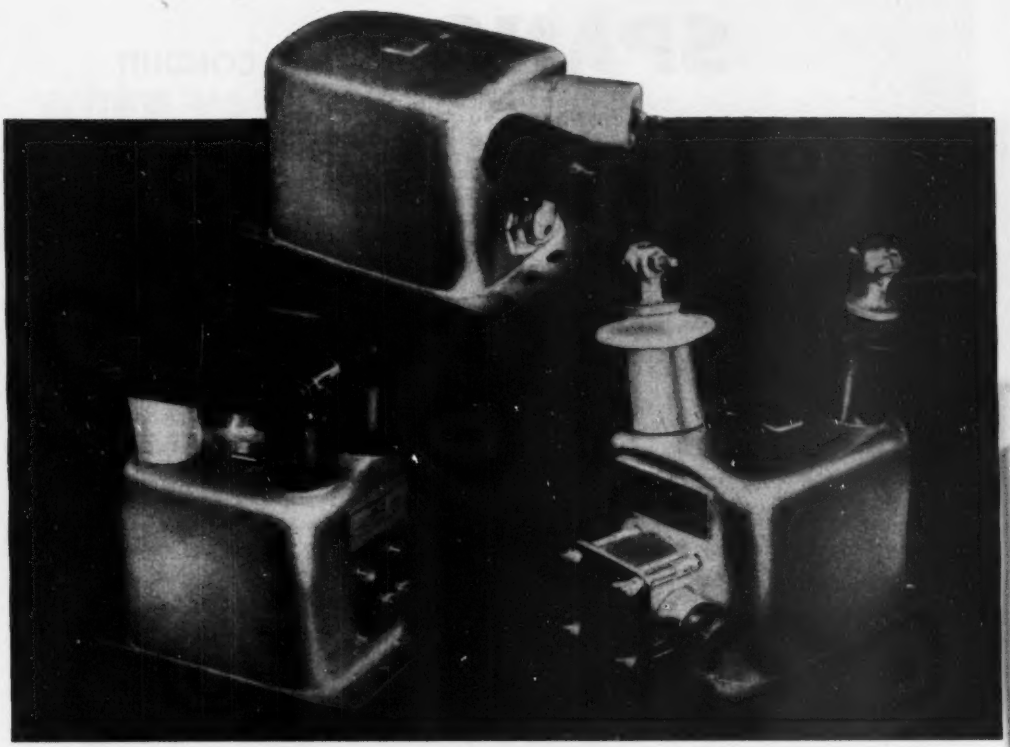
DURALINE beats the weather in any season. Its exclusive, continuous interlocked fibrous sheath is thoroughly impregnated with genuine URC saturants and covered with URC finishers.

For the full technical story on Duraline with copper, Copperweld or aluminum conductor, just contact your nearest Anaconda Sales Office. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U.S. Pat. Off.

the right cable for the job

ANACONDA® **WIRE AND CABLE**



NEW 2400-VOLT Potential Transformers

EASIER TO MOUNT . . . IN ANY POSITION!

Completely redesigned . . . inside and out . . . the new Westinghouse 2400-volt Potential Transformers are easier to handle, may be installed in any position.

In addition to improved mechanical design, these transformers have compact, lightweight Hipersil® Cores, and new crepe-paper insulation. Vacuum drying, then plastic impregnation and filling under vacuum, results in exceptionally low-insulation power factor, high impulse and dielectric strength. These transformers meet ASA standards for metering and relaying accuracy.

All units are enclosed in deep-drawn steel cases, the only weld being where the base joins the side walls. A new filling plug, plus flangeless bushings, assures leakproof connections.

The new Westinghouse 2400-volt Potential Transformers are available with or without fuses, Type PT for indoor or Type PTO outdoor service. For further information, contact your Westinghouse representative or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70635

YOU CAN BE SURE...IF IT'S
Westinghouse
INSTRUMENT TRANSFORMERS

SPANG CENTRAL CONDUIT

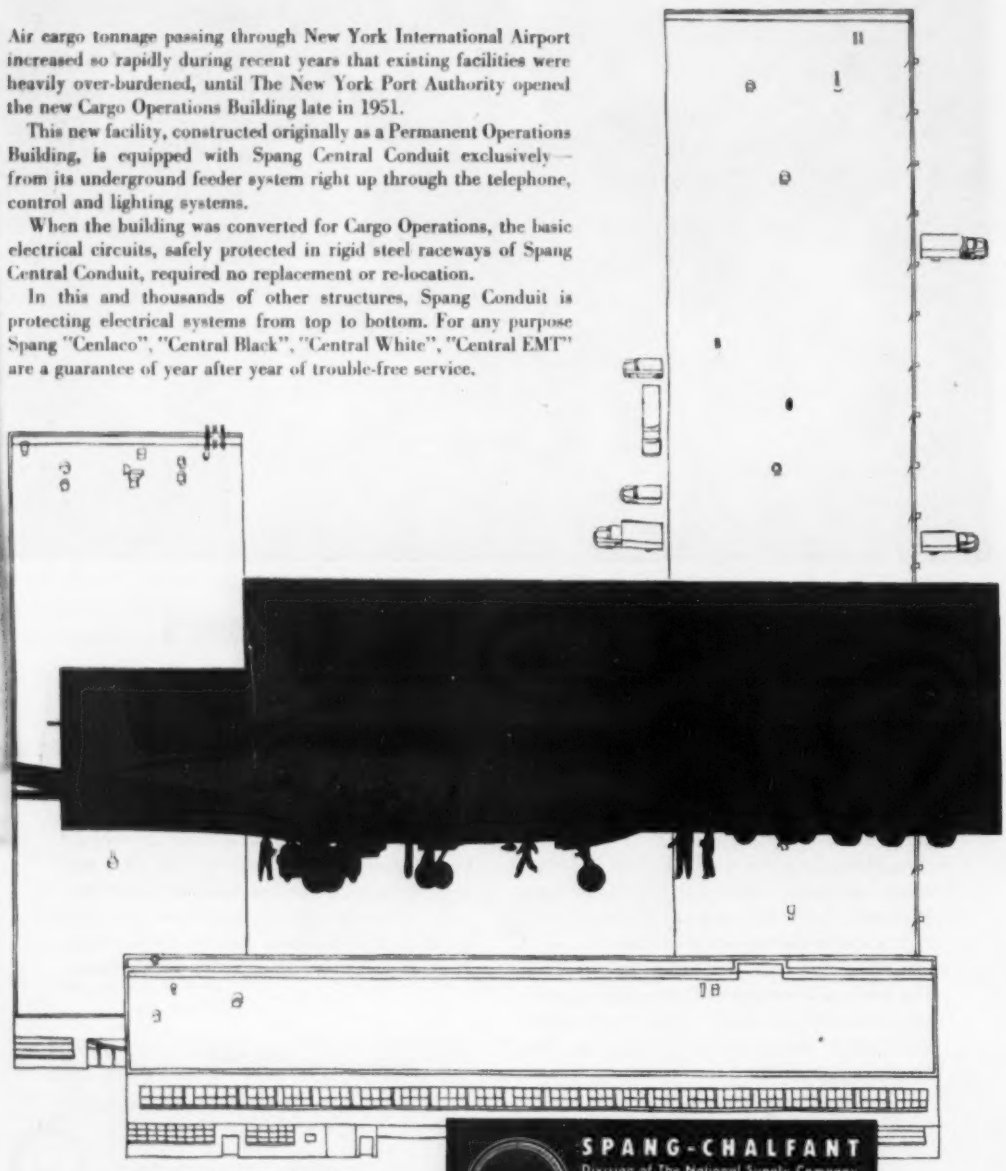
serves IDLEWILD'S newly completed air freight terminal

Air cargo tonnage passing through New York International Airport increased so rapidly during recent years that existing facilities were heavily over-burdened, until The New York Port Authority opened the new Cargo Operations Building late in 1951.

This new facility, constructed originally as a Permanent Operations Building, is equipped with Spang Central Conduit exclusively—from its underground feeder system right up through the telephone, control and lighting systems.

When the building was converted for Cargo Operations, the basic electrical circuits, safely protected in rigid steel raceways of Spang Central Conduit, required no replacement or re-location.

In this and thousands of other structures, Spang Conduit is protecting electrical systems from top to bottom. For any purpose Spang "Cenlaco", "Central Black", "Central White", "Central EMT" are a guarantee of year after year of trouble-free service.



Owner: The Port of New York Authority.
Architects: Lorimer and Rose, New York.
General Contractor: Corbetta Construction Co., New York.
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You'll know **WHY** these leading companies selected **HONAN-CRANE** oil purification equipment

FOR THEIR TURBINES, DIESELS, TRANSFORMERS, CIRCUIT BREAKERS, SWITCH GEAR AND OTHER OIL-FILLED EQUIPMENT

ABITIBI POWER & PAPER CO. LTD. Iroquois Falls, Ontario	ETHYL CORP. Baton Rouge, Louisiana	SCRANTON ELECTRIC CO. Scranton, Pennsylvania	MINNKOTA ELECTRIC SERVICE CO. Fargo, North Dakota	MEMPHIS POWER & LIGHT Memphis, Tenn.
THE ANNEVAR MILLS Revenna, Ohio	FLORIDA POWER CORP. St. Petersburg, Fla.	UNION ELECTRIC STEEL CORP. Carnegie, Pennsylvania	MISSOURI PACIFIC R. R. CO. St. Louis, Missouri	MUNICIPAL LIGHT & POWER PLANT Hutchinson, Minn.
CENTRAL KANSAS ELECTRIC COOP. ASSOC., INC. Great Bend, Kansas	NORTHERN STATES POWER CO. Minneapolis, Minn.	WESTON STEEL CO. Weirton, West Virginia	MURRAY CORP. OF AMERICA Detroit, Michigan	CENTRAL MAINE POWER CO. Augusta, Maine
CINCINNATI GAS & ELECTRIC CO. Cincinnati, Ohio	OMAHA PUBLIC POWER DISTRICT Omaha, Nebraska	WESTINGHOUSE ELECTRIC INT'L New York 5, New York	MUNICIPAL ELECTRIC PLANT Gtesmo, Miss.	KAISER ALUMINUM AND CHEMICAL CORP. Chalmette, La.
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CORPORACION PERUANO DEL SANTA Lima, Peru	PHELPS DODGE PRODUCTS CORP. Indiana Rod & Wire Div. Fort Wayne, Indiana	INDUSTRIAL RAYON CORP. Painesville, Ohio	CITY OF LOGANSPORT Logansport, Indiana	MUNICIPAL POWER PLANT Colby, Kans.
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. . . and many others!

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819 Wabash Avenue, Lebanon, Indiana

Gentlemen:

Please send me Free Copy of your booklet, "Proven Protection Against Oil Failure."

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ALL Honan-Crane Equipment is Sold on a PERFORMANCE GUARANTEED Basis

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ALCOA

and Alcoa Workmanship

Over 2,000,000 miles of ACSR have been produced by Alcoa. Positive testimony to the *quality* cable offered by Alcoa.

Today, the same exacting workmanship that governed this total continues to supply you with the best ACSR. Shown here is one of many stranding machines that spins strong, light weight cable at Alcoa's Mills.

Exacting inspections maintain the high standards of Alcoa ACSR. This assures you cable with uniform stranding . . . steel core wire rigidly inspected to meet ASTM specifications . . . cable in uniform lengths, clearly marked on reels.

You get *quality* cable plus Alcoa's 54 years' cable experience. Our field engineers can offer you up-to-date installation and maintenance techniques. Call the nearest Alcoa Sales Office or write:

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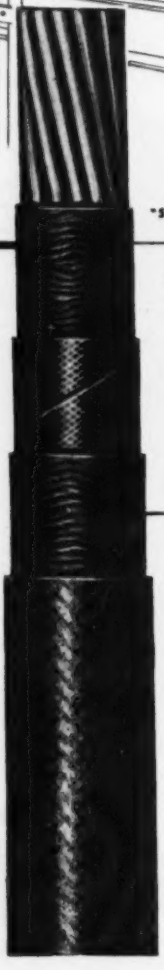
Alcoa has developed a complete line of aluminum accessories to help you build your T. & D. lines faster and better.

Building or Planning New Construction?

ROCKBESTOS A.V.C.®

PERMITS UP TO 50% FUTURE LOAD GROWTH



IT'S THE A.V.C. "SANDWICH" THAT MAKES THE DIFFERENCE

Inner Felted Asbestos Wall

Varnished Cambric

Outer Felted Asbestos Wall

This "sandwich" protects the varnish cambric. It enables A.V.C. to carry more current than cables with conventional insulations

Now, when the building is in the construction stage, is the time to plan for future load growth. By using Rockbestos A.V.C. on a size for size basis with R or RH, you automatically provide up to 50% for future load growth. And, best of all, you get this advantage without using more steel, more man hours or more copper.

New buildings or old, Rockbestos is a dollar-saver, time-saver!

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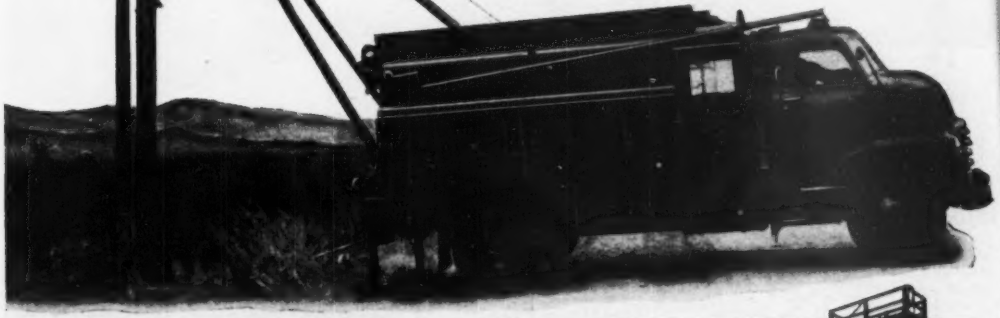
HOLAN . helping to give Americans their best bargain !

The cost of living, according to the recent price index, is at an all-time high. Yet, the cost of utility service to the American people is less than it was years ago. It is truly America's best buy.

Playing an important part are Holan utility bodies. In recent years Holan engineers have introduced a number of important time and labor saving features that help utility companies maintain lower costs for construction, maintenance and service work. Many of these features are exclusive with Holan bodies.

Compare Holan bodies before you buy. See what a difference they can make in your costs.



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Main steam piping at Salem Harbor Station of New England Power, 1000° F and 1450 psi, supported by Grinnell Constant Support Hangers.

Problem:

PIPING THAT GROWS...

Solution:

GRINNELL ENGINEERED HANGERS

Eight . . . nine . . . ten inches of thermal deflection! That's not a bit uncommon in today's high temperature, high pressure systems. Very hard-to-come-by, though, is the skill necessary for dealing successfully with suspension problems resulting from *"piping that grows"* . . .

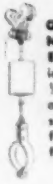
Large manufacturing facilities, expert technicians, and a lot of down-to-earth practical knowledge are needed.

Grinnell is America's No. 1 supplier of pipe hangers and supports, because Grinnell combines modern manufacturing with expert background knowledge gained during a century of piping specialization. Grinnell has developed hangers and supports for *every* piping need, from the simplest to the most complex. Grinnell, and Grinnell alone, can offer these advantages:

- Complete "start-to-finish" production facilities—including research, design, manufacturing, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution—enabling "out of stock" purchases, anywhere.

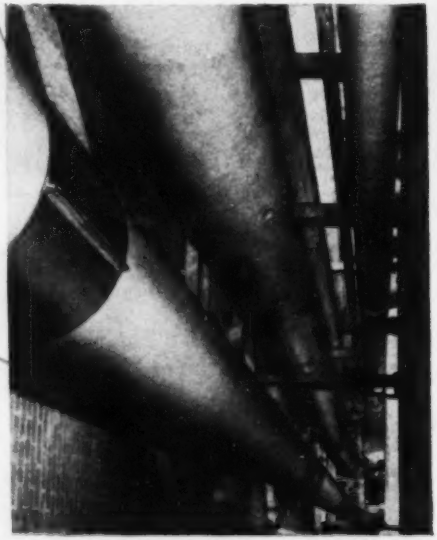
Grinnell is always ready to cooperate with engineers and architects in the preparation of pipe suspension specifications. Call Grinnell for pipe hangers and supports.

GRINNELL MODEL L CONSTANT SUPPORTS maintain full safety factor in high temperature, high pressure systems. 3 physical structures accommodate maximum travel requirement of 2½, 5 and 10 inches; 16 sizes collectively cover numerous load ranges between 121 and 19,530 lbs.



GRINNELL PRE-ENGINEERED SPRING HANGERS — maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. 16 sizes available from stock — load range from 74 lbs. to 9000 lbs.

GRINNELL VIBRATION CONTROL AND SWAY BRACES — dampen vibration, oppose pipe sway and absorb shock. 3 sizes give full deflection forces from 200 to 1800 lbs.; have initial precompressed spring forces from 50 to 450 lbs. respectively.

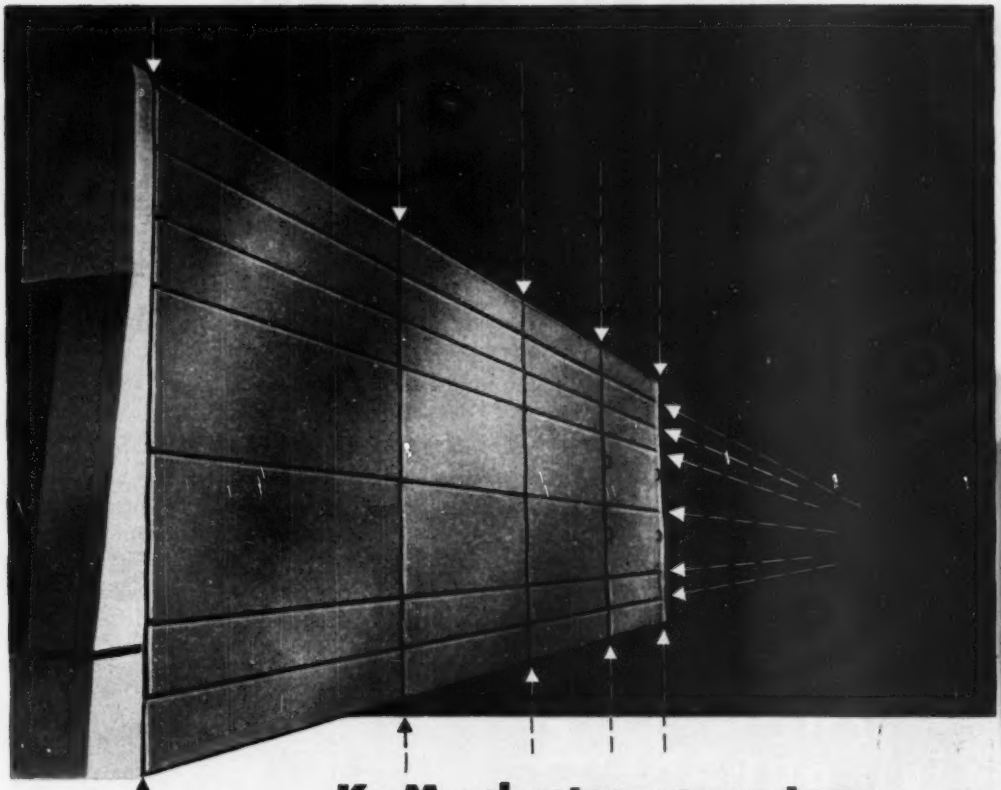


GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

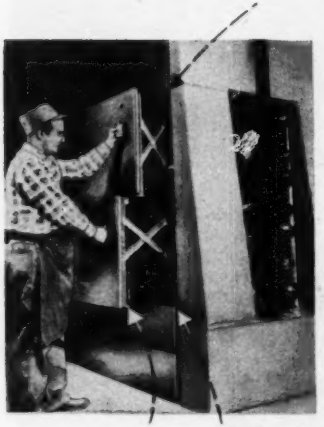
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



K & M asbestos woven tape

keeps heat in, tightly sealing the joints of this new, prefabricated oven to insure its flexible adaptability



The Advanced Heating Division of Jensen Specialties, Inc., Detroit, Michigan, is producing a new type of prefabricated electric oven for accelerating heating schedules on industrial processing applications up to 700°F. Radiant Calrods in panel type construction accomplish this when assembled on standardized demountable frames. By varying the number of panels and their arrangement, ovens of any size, shape and heat capacity can be field assembled at will. They may also be converted from one application to another without cutting or otherwise damaging the component parts.

The problem of tight thermal construction in this "portable" oven is efficiently solved by the use of K & M Asbestos Woven Tape to seal the joints. Fireproof, tough, uniform, and flexible, this tape can be quickly, easily, and economically applied in any assembly or adaptation of the oven.

K & M Asbestos Woven Tape, specifically designed for the insulation of wires, coils, and cables in the electrical industry, fits the above role well, as it does many others, including the insulation of hot pipes and bends, especially of small diameter. For electrical purposes, it fully meets, in thicknesses from .015" to .030", the A.S.T.M. specifications. It is supplied in the ferrous type for higher temperatures and in the non-ferrous type where voltages as well as temperatures are extremely high.

Other Keasbey & Mattison products rendering outstanding service to the electrical, as well as other, industries are Braided Asbestos Tubing, Twisted Asbestos Cord, Asbestos Yarn, Asbestos Thread, and Asbestos Cloth. For information about any of these versatile products—and name of your nearest K & M distributor—write us.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

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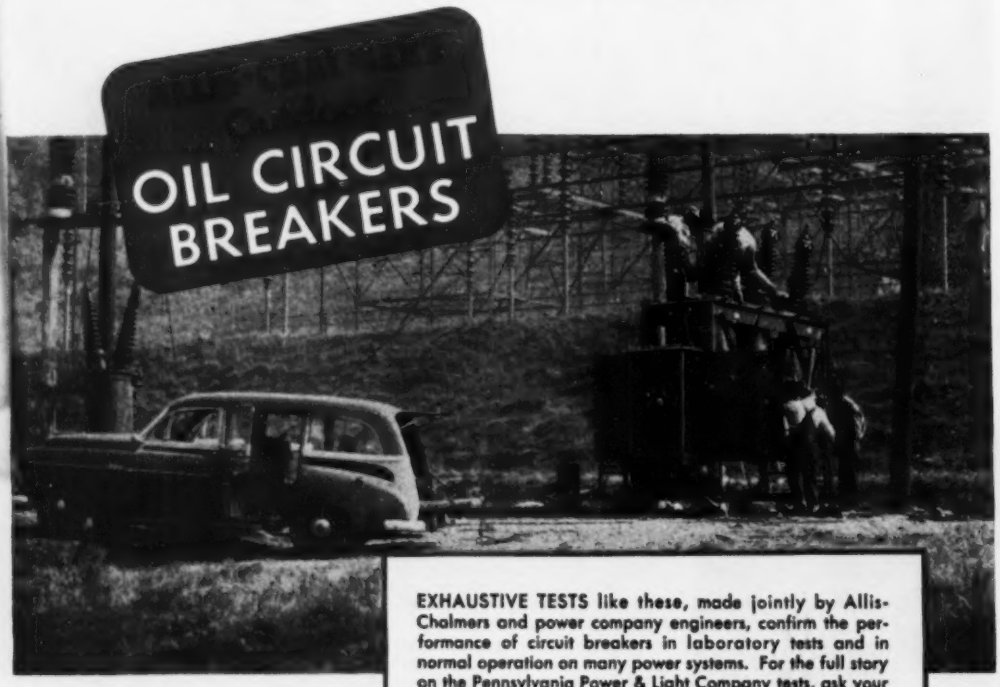
HOW MUCH Can a Breaker Take?

Here's the Answer Provided by Field Tests on Pennsylvania Power & Light Company System

In a single test series, a standard Allis-Chalmers 69-kv breaker provided Pennsylvania Power & Light Company engineers with positive proof of its ability to:

1. Interrupt a total kva power of approximately *18 times* its interrupting rating — *with no maintenance or adjustment* during the test period.
2. Include, in the total, *eleven* fault interruptions at or above full breaker rating.
3. Pass a group of line-charging and discharging tests *without a restrike.*
4. Show, on inspection after test, that more service could safely be expected.



Standard production-line FZO-151-69P breaker was used for these field tests.

EXHAUSTIVE TESTS like these, made jointly by Allis-Chalmers and power company engineers, confirm the performance of circuit breakers in laboratory tests and in normal operation on many power systems. For the full story on the Pennsylvania Power & Light Company tests, ask your A-C representative for Bulletin 71R7855, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3791

ALLIS-CHALMERS

Workshop on wheels!

Put the service-utility body you need on an International Truck and you have a workshop on wheels. It's engineered and powered to go anywhere, any time, under any conditions.

What's more it will go economically and it will keep going that way for years. The powerful valve-in-head engine takes it easy on gas and oil. Extra years of like-new operation are engineered into every truck. And you can take comfort and ease of handling for granted.

Get the rest of the story from your International Dealer or Branch. You'll like it.

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Look for these International exclusives:

- **Silver Diamond valve-in-head truck engines are rugged, packed with extra power. Engineered to save you plenty on operating and maintenance costs.**
- **The "roomiest, most comfortable cab on the road"— the Comfo-Vision Cab. One-piece Sweepsight windshield. New green-tinted, non-glare safety glass available.**
- **Super-steering system—more positive control. Wider front axles make possible full 37° turning angle for greater maneuverability.**
- **115 basic models . . . everything from ½-ton pickups to 70,000 lb. GVW ratings. Chassis adaptable to a wide variety of body types.**

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Better roads mean a better America

INTERNATIONAL TRUCKS

"Standard of the Highway"

International L-160 series. GVW ratings 14,000 to 16,500 lbs. Wheelbases 130, 142, 154, and 172 in.

GUARANTEE

QUALITY ELECTRICAL

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ACCURATE
FRICTION TAPES

Quality made of highest grade rubber and finest cotton base. Affords maximum mechanical protection. Available in Standard and A.S.T.M.-A.A.R. Specification grades.

ACCURATE
RUBBER TAPES

Offers high elasticity, excellent cohesion, high dielectric strength and super aging qualities; made in both Standard and A.S.T.M.-A.A.R. grades.

ACCURATE
PLASTIC TAPE

This caliper reduces bulk in tight spots. Strong mechanically and offers high dielectric strength. Recommended for use wherever plastic tape is practical.

TAPE TIPS:
FOR ELECTRICAL MEN

Using rubber tape that coheres without heat or extra pressure, makes taping jobs easier, quicker. That's ACCURATE, and super aging means your "wraps" improve with age. Remember — friction or rubber, ACCURATE Tapes make *accurate* wraps!

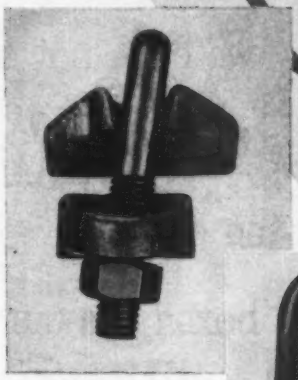
ACCURATE YOUR BEST BUY IN TAPE

MORE THAN A QUARTER CENTURY OF TAPE SPECIALIZATION

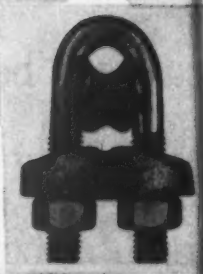
Dependable

MIF GUY CLAMPS

Never let a guy down!



PAX67 Clamp rated 12,500 lbs. Note relative position of parts during tilting. Separating Block and Clamping Plate remain parallel at all times.



- **GREATER HOLDING POWER**
  Clamping force increases as load increases. "Come-along" type grip minimizes human element in installation.
- **GREATER EASE OF INSTALLATION**
  Can be placed on strand in a matter of seconds. Holds strand in proper position while nuts are being tightened.
- **GREATER FLEXIBILITY**
  Each size accommodates a wide range of strand diameters. Substantial savings in handling and inventory.
- **GREATER ECONOMY**
  Low weight and cost per unit of holding power.

PAX64C accommodates 3/8"-3/4" dia. strands.

MIF UNIVERSAL CLAMPS

This series of clamps offers same unusual performance characteristics with added advantage of equal clamping surfaces on both wires. Particularly recommended on conductors or for general use where system standardization is desired.

SPECIFICATIONS

Cat. No.	# Rating lbs.	Strand Dia. Range	Wgt. Per C Pcs.
PAX64	7,500	3/8"-3/4"	85 lbs.
*PAX67	12,500	1/4"-1/2"	122 lbs.
*PAX64C	7,500	3/8"-3/4"	67 lbs.
PAX67C	12,500	7/16"-1/2"	142 lbs.

* Illustrated

#PAX64 & PAX64C Based on tests with nuts tightened to 45 ft./lbs.

PAX67 & PAX67C Based on tests with nuts tightened to 85 ft./lbs.

MALLEABLE IRON FITTINGS CO.

Pole Hardware Division Branford, Connecticut

N. Y. Office: 30 Church St.

Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd. TORONTO

MIF

Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JBG Electric Co., Chicago, Ill. • E. H. McCain, Knoxville, Tenn. • E. A. Thornwell, Inc., Atlanta, Georgia • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Kruel, San Francisco, Calif. • L. G. Woodward, Kansas City, Mo. • Williams Sales Co., Fort Myers, Fla. • Williamson Sales Co., Shreveport, La. • O. C. Witte Co., Detroit, Mich.

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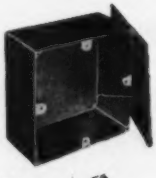
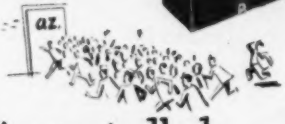
And now we have not one or two

but three times the capacity

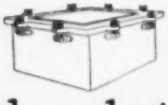
to meet the demand for

cast iron boxes like our types YS  and YE

Everybody wants them 

for **O.Z.** boxes are quality controlled

from drawing board

to completed box 

Of course, increased production

means revised

Write for your new price list today!

They're OK if they're O.Z.

O.Z. ELECTRICAL MANUFACTURING COMPANY, INC.

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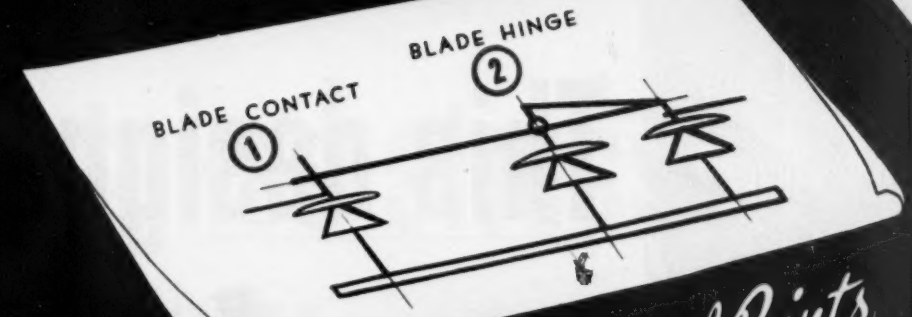
CONDUIT FITTINGS • CABLE TERMINATORS • CAST IRON BOXES
SOLDERLESS CONNECTORS • GROUNDING DEVICES • POWER CONNECTORS



are the Critical Points on any outdoor switch

and Here's how

R&IE

HAS FORTIFIED EACH OF THESE CRITICAL POINTS!

Check the Facts

1. Hi-Pressure Contact—an original R&IE development now a recognized industry standard. Exhaustive design research concludes that the most effective jaw construction is—beryllium copper for strength and resiliency, and copper contact fingers for high thermal capacity.

This R&IE modern design provides inherent spring pressure, thereby eliminating back-up springs and associated sluggish contact action.

AND YET, this unavoidable necessary make-and-break Contact, highly perfected as it is, IS MORE VULNERABLE TO HAZARDS than—

2. Sealed Pressure Hinge Contact. Enclosed, weather-sealed, silver-to-copper hinge contacts are always protected and clean. Continuous annular, constant electrical contacts ENTIRELY ELIMINATE ANY SECOND MAKE-AND-BREAK CONTACTS.

High thermal capacity enables these contacts to withstand more than twice the momentary rating of the switch, without damage, THUS ELIMINATING ANY NECESSITY FOR INSPECTION. However, hinge contacts may be opened, inspected and reassembled in minutes.

R&IE enclosed and protected contacts carry current,—REQUIRE NO BY-PASSING OF ANY PART OF THE HINGE.

Why have more than one make-and-break contact?

R&IE EQUIPMENT DIVISION
I.T.E. CIRCUIT BREAKER CO.
GREENSBURG, PENNSYLVANIA

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

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INTERRUPTER SWITCHES

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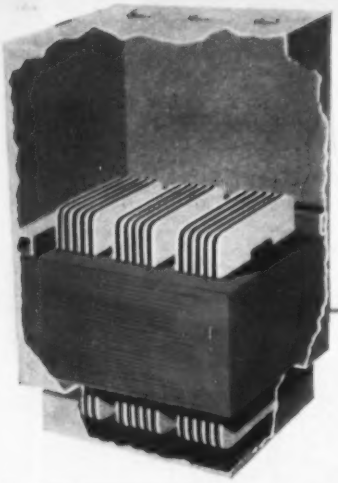
OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES



This design

takes stress better

The Form-Fit design of Westinghouse Power Transformers has inherent advantages that no other transformer can equal for handling both surge and short-circuit stresses.

The fact that the winding contains only a few coils of large plate area, results in the best relationship between series capacitance and ground capacitance and gives, inherently, more uniform distribution of lightning surge across the winding. This construction eliminates the need for shields, arresters or other internally mounted protective devices likely to cause trouble. As a result, operating hazards are minimized . . . design margins and safety factors are increased.

Because short circuits set up, in all transformers, magnetic fields that tend to force high and low-voltage coils apart, Westinghouse Form-Fit Transformers are arranged with high and low-voltage coils interspersed, so that these forces, acting over broad areas, essentially balance each other and are reduced to absolute minimums. Furthermore, because the core surrounds, supports and protects the coils, the mechanical strength of the mass of core material is added to the strength of the case, providing an unbeatable combination to withstand all mechanical stresses.

To all this, add the advantage of more efficient cooling, and the saving in installation cost because they are smaller and lighter than any comparable transformer, and you'll quickly see why it pays to specify Westinghouse Form-Fit Power Transformers.

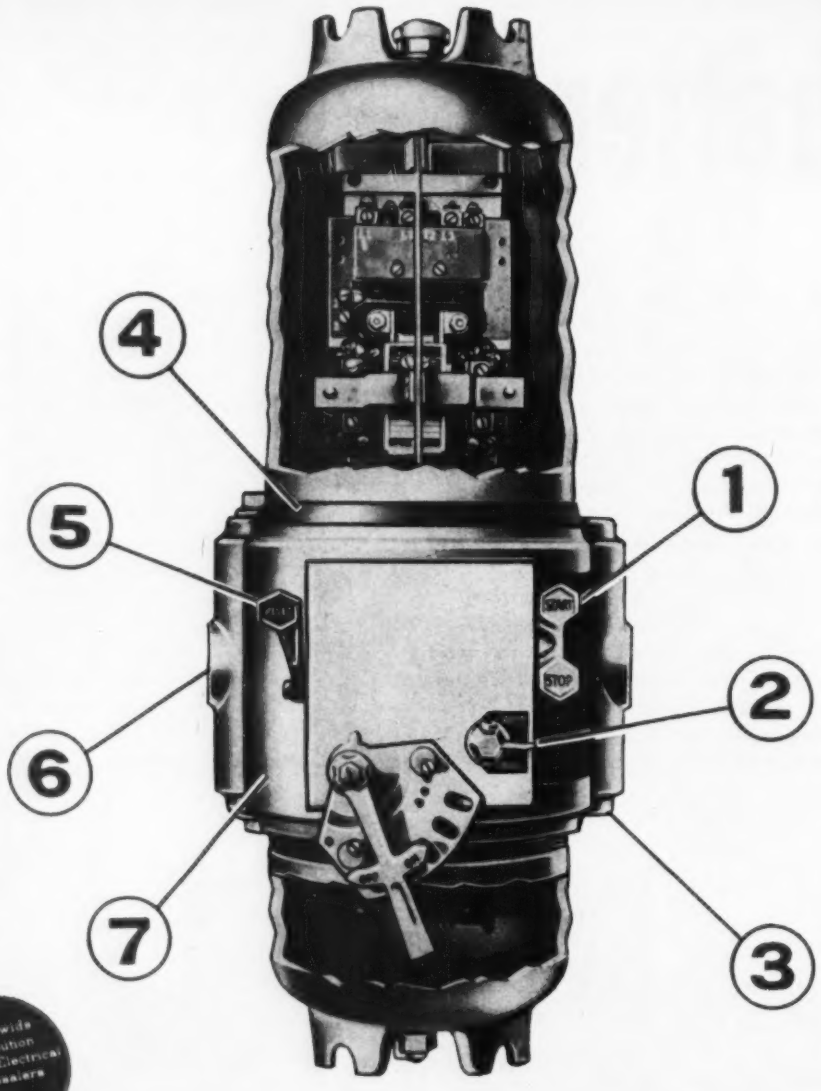
Ask your Westinghouse representative for further information, or write for Booklet B-4142A: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70643

YOU CAN BE SURE...IF IT'S
Westinghouse
POWER TRANSFORMERS

50,000-kva, 132-kv transformer installed at West Penn Power Company's Mitchell Station.

7 important NEW features

... to the many basic advantages of



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have been added
CROUSE-HINDS Type EPC
motor starter and circuit breaker CONDULET *

You get all of them on the Model M52

Model M52 EPC is the most flexible explosion-proof line starter and circuit breaker enclosure ever produced. The addition of 7 new features to the proven basic advantages of the EPC construction assures the greatest ease of installation and maintenance.

The exclusive basic advantages of the EPC Condulet have made it the world's leading enclosure for housing motor starters, circuit breakers and combinations for use in hazardous locations.

The basic advantages are:

EASY INSTALLATION . . . The use of a strong light-weight aluminum alloy and the unique three-section design makes it practical for an electrician and his helper to install the largest housing without the use of costly lifting equipment. The internal devices can be easily removed for pulling in the wires.

THREADED JOINT CONSTRUCTION . . . All joints are threaded. All operating shafts and bushings are thread-in-thread construction. This insures maximum safety, easy inspection and maintenance, and maximum corrosion protection.

FLEXIBILITY . . . A large number of different enclosures can be assembled from the wide variety of sizes of bodies and covers. They are not only used for circuit breakers and starters but have proven adaptable for many other types of electrical equipment. The body has numerous conduit hubs for flexibility of installation.

COST AND TIME SAVINGS . . . The outstanding advantages of the unique EPC Condulet over conventional explosion-proof enclosures all add up to lower installed cost and lower maintenance cost.

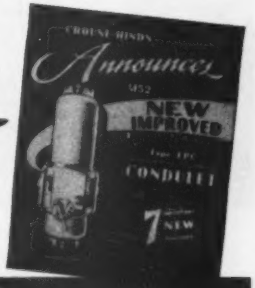
All of these advantages have been available for years.

Now Crouse-Hinds offers you 7 new improvements to underline the basic advantages of type EPC Condulets and to save you more dollars and more man-hours than ever before.

1. **Built-in Push button stations** available on line starters and combinations of line starters with circuit breakers — START — STOP, FOR — REV — STOP and HIGH — LOW — STOP stations for regular, reversing, or two-speed starters.
2. **Built-in selector switch** is available on line starters and combinations of line starters with circuit breakers. Normally supplied marked HAND — OFF — AUTO or JOG — RUN — OFF, three-position style. Two-position selector switch or combinations of selector switch with START — STOP station can be supplied.
3. **Back conduit entrance** can be supplied by drilling and tapping the boss in the center of the back . . . in addition to the four regular top and bottom hubs.
4. **Protective Neoprene gasket** is available for the upper cover joint. Where EPC Condulets are exposed to unusually severe weather or corrosive conditions, this gasket provides additional protection.
5. **A new RESET lever with threaded shaft,** rotating within a threaded bushing, provides easier and more positive operation of the reset mechanism.
6. **Horizontal through-feed conduit entrances** are provided by drilling and tapping bosses on the sides of the Condulet body.
7. **Greater ease in wiring** is provided by increased height in the center body section and by universal use of open framework mountings for circuit breakers and starters in the new model M52 EPC Condulets.

Model M52
Type EPC Explosion-Proof Condulet in 7, 9, and 11-inch body sizes

Send for YOUR copy of Bulletin 2634



* CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

OFFICES: Albuquerque – Birmingham – Boston – Buffalo – Chicago – Cincinnati – Cleveland – Dallas – Denver – Detroit – Houston – Indianapolis – Kansas City – Los Angeles – Milwaukee – Minneapolis – New York – Philadelphia – Pittsburgh – Portland, Ore. – San Francisco – Seattle – St. Louis – Tulsa – Washington. RESIDENT REPRESENTATIVES: Albany – Atlanta – Baltimore – Charlotte – New Orleans – Richmond, Va. Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

AIRPORT LIGHTING • FLOODLIGHTS

EXAMINATION OF MANY CABLES LAID IN TERMITE AREAS has given General Electric considerable data on this unusual subject. It is an example of the scope of information you can get when you come to General Electric with your wire and cable problems.

WIRE AND CABLE FOR ELECTRIC UTILITIES

What we learned about Termites

CAN HELP SOLVE YOUR CABLE PROBLEMS

In General Electric's extensive files of information about cable performance there is considerable data concerning the damage a termite can do to electric cable insulation. The termite was a serious problem to an electric utility in the South which recently came to us for help. The information we had available, which was of great help in solving this utility's termite problem, can be valuable to you if you are installing cable in areas where termites abound.

This same utility also asked us about short-circuit coordination when relatively small-sized cables were connected to buses having high short-circuit capacity. The answer we furnished, in a form for easy cable selection, was prepared here in Bridgeport.

In addition to this, we secured additional data from other General Electric plants for this utility where their cable questions were related to transformers and motors, circuit breakers, and other apparatus. Although the utility came to our Wire and Cable Department for a single coordinated answer, data that was necessary for a complete answer also came from Schenectady, Pittsfield, Philadelphia, Lynn, Panama, and Bridgeport—an indication of General Electric's reservoir of experience and information on problems affecting electric utility installation of electric cable and electric equipment.

Answering diverse questions such as these is not unusual for the Wire and Cable Department of General Electric. Similar questions come to us every month from electric utility companies around the nation. These utilities have learned that our never-ending search to provide the right cable for the job has resulted in a rich storehouse of information. We hope that you, too, will call on us to help solve your wire and cable problems.

TEMPERATURE-RISE obtained as a function of time and current for various cable sizes has been charted by General Electric as a part of continuing studies to develop superior cable. This information, and much more, has been made available by General Electric for the entire electric utility industry.

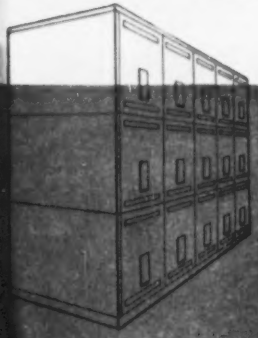
Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

W4-182

GENERAL ELECTRIC

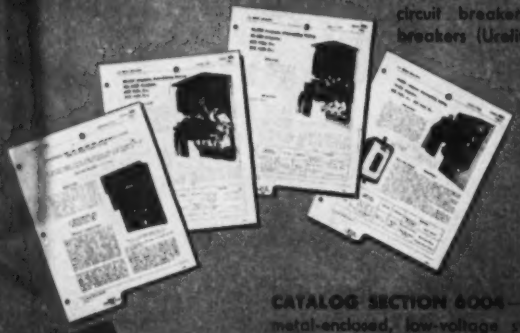
To simplify switchgear problems...plan your

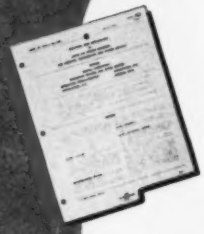


BEFORE YOU SPECIFY—SEND FOR YOUR FREE COPIES OF THIS INFORMATIVE I-T-E LITERATURE

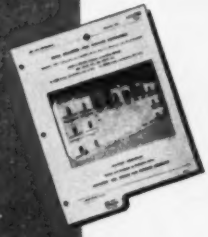
I-T-E Selection and Application Data is specially prepared by I-T-E application engineers to help you through the important steps in planning your switchgear system.

CATALOG SECTION 1003—Comprehensive, illustrated 50-page catalog contains complete data on selection and application of I-T-E low-voltage air circuit breakers and individually enclosed circuit breakers (Ureilites).





CATALOG SECTIONS 1104, 1304, 1404, 1504—Detailed description of construction, operation, and application of I-T-E's KA, KB, KC, and LG circuit breakers—and I-T-E's full line of auxiliary and trip devices. Catalogs give you useful tables, wiring diagrams, mounting instructions, and dimensions.



CATALOG SECTION 6004—gives full information on I-T-E Multumite metal-enclosed, low-voltage switchgear. Completely describes I-T-E drawout construction and cubicle design. Contains useful specifications, dimensions, and suggestions for planning your metal enclosures.

FREE

I-T-E CIRCUIT BREAKER CO.
Switchgear Division, Dept EW
19th and Hamilton Sts.
Philadelphia 30, Pa.

Please send me the catalogs which I have checked:

- ☐ Catalog Section 1003
- ☐ Catalog Sections 1104, 1304, 1404, 1504
- ☐ Catalog Section 6004

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I-T-E

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Canadian Mfg. & Sales:

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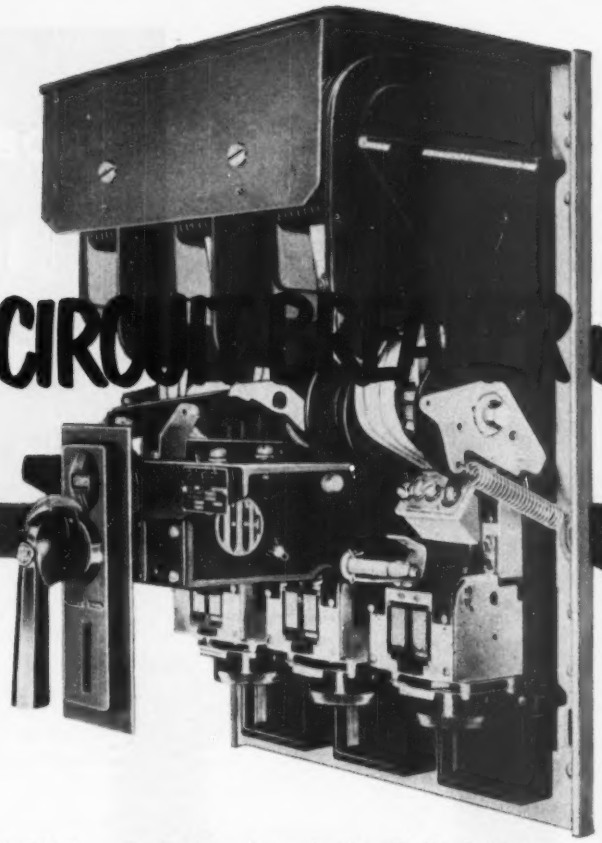


I-T-E CAN SUPPLY INDOOR AND OUTDOOR EQUIPMENT IN RATINGS:

15,000 to 100,000 amperes interrupting
600 volts a-c, 250 volts d-c
to 6,000 amperes continuous, a-c or d-c
to 10,000 amperes continuous, d-c only

Expansion or modernization of your electrical distribution system calls for detailed analysis. Before you can properly select your system and equipment, you must consider such important factors as load, power supply, circuits, *protection*, and *reliability*.

This means getting down to fundamentals. And, fundamentally, system reliability depends on *circuit breaker* protection. That's why it pays to think of your switchgear requirements *first of all* as circuit breaker applications.

Follow these three simple steps when planning your switchgear layout. You can then be sure that the circuit breakers you buy will provide the protection you need:

- **KNOW YOUR APPLICATIONS**—their load characteristics, protection requirements, need for continuity of service;
- **KNOW THE CIRCUIT BREAKER** features and functions that will satisfy all application requirements;
- **KNOW THE MANUFACTURER**—his ability to help you solve your problems and provide the best breakers for the job.

I-T-E experience and specialists are at your service. Your local I-T-E application engineer will gladly work with you on any switchgear problems. Get to know him. Give him a call—*today*.

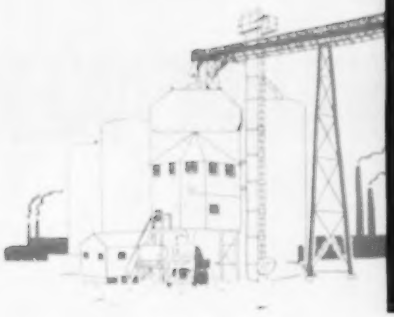
VOLTAGE SWITCHGEAR

BREAKER COMPANY • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., N.Y. 17, N.Y.

PROBLEM:

Industrial Contamination



LAPP LINE POST

"All-time champion" among transmission insulators in point of service dependability at duty up to 69 kv. Its record, both on new construction and after reinsulation of lines to higher voltages, has been built on ability of Line Post to avoid leakage flashover, to withstand lightning arcover and mechanical attack, its inherent freedom from puncture and cracking.

LAPP STATION POST

In addition to the superior electrical and mechanical characteristics inherent in Lapp Post design, Station Posts also possess extra rigidity. Cap and base are externally attached for large-area low-intensity compression loading of porcelain, as contrasted to small-area, high-intensity loading of nested porcelain and metal parts in conventional pin-cap switch insulators.

LAPP FOG-TYPE SUSPENSION INSULATOR

For high-voltage lines in areas of severe contamination—salt fog, industrial fumes, or dust—Lapp Fog-Type suspension units provide maximum leakage distance per length of string—and for greater effectiveness of leakage distance, inch for inch.

SOLUTION:

Lapp Fog-Type Design

Service dependability on lines subjected to severe contamination . . . industrial smoke and fumes, dust, or salt fog . . . can be assured—without frequent cleaning of insulators—and without danger of failure from leakage flashover. Lapp Fog-Type design provides superior performance for transmission, switch and bus support because of two basic superiorities of design principle . . .

1. UNIFORM LEAKAGE PATH

Leakage flashover results from a contaminated surface which is not uniform—wet areas lower total resistance, so increase leakage current until voltage flashes over narrow shielded areas, precipitating flashover of entire unit. Compare developed uniform leakage surfaces of 66 kv Line Post (on left side) with that of conventional pin-type (right) where variation in conductivity is 3.6 times as great.

2. SELF-CLEANING

Under heavy rain and wind, contamination rapidly flushes away. Fog-Type petticoats are so shaped and spaced that rain falling on one petticoat splashes and cleans the under side of the one above. Resistance increases, leakage current falls—uniformly and over entire unit.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, NEW YORK

STEAM POWER for Kaiser

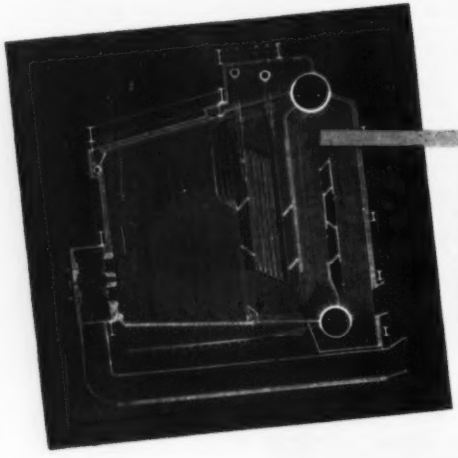
15 FOSTER WHEELER STEAM GENERATORS SERVE THE SOUTH'S BIG NEW

For every pound of aluminum produced in this new 400,00,000 pound-per-year plant, Kaiser will need about 10 kwh of electric power.

To meet this enormous, almost constant demand, Kaiser Engineers selected a plant consisting of gas-burning radial engines, and 15 Foster Wheeler "D" type boilers to supply steam for the turbine-generators.

These boilers, with a combined capacity of 3,375,000 lb of steam per hr, are ideally suited to Kaiser's requirements for reliability, ease of operation and high availability. And they are a natural for use in the South where a temperate climate permits low-cost, semi-outdoor-type installations.

This installation is another example of Foster Wheeler's ability to design and construct power-producing equipment to meet the needs of industry.



Cross-section of one of the 15 duplicate Foster Wheeler "D" type steam generators for Kaiser Aluminum. The regenerative air heater is not shown.

CAPACITY	225,000 lb per hr
PRESSURE	900 psig
FINAL STEAM TEMPERATURE	905 F
TEMPERATURE FEEDWATER INLET	350 F
FIRING	Natural Gas

For information on your steam generation

Aluminum

INDUSTRY AT CHALMETTE, LA.

Aerial view showing first six boilers and six of the eight stacks under construction. Nine more boilers, now being fabricated, will be located in extension of the present line. Turbine room is to the left.

requirements, write to: FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK

FOSTER WHEELER

ONCE upon a time there were six blind men, each of whom touched a different part of an elephant's body and came up with six different descriptions of it.

It might be well to remember this when considering the purchase of transformers. Unless the manufacturer considers the product's purpose objectively, it is quite possible that over-all performance will be sacrificed. Unbalanced design will not produce the efficient distribution system you are seeking.

Moloney products are designed and produced with your needs in mind. Over 50 years of experience in engineering, research, design and fabrication are combined to produce the best all-around transformers that you can buy. For better performance, greater reliability and less maintenance . . . specify Moloney.

MS-52-11

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers · Distribution Transformers · Load Ratio Control Transformers Step Voltage Regulators · Unit Substations

MOLONEY ELECTRIC = BETTER PERFORMANCE, GREATER RELIABILITY, LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Should SEC Reshuffle Utility Systems?

Can the Securities and Exchange Commission do a better job of combining utility systems than the utilities themselves? That is the basic question raised by Chairman Donald C. Cook in his proposal to study uneconomic situations in utility operating systems.

All of the utility operating and holding companies will agree with Cook that, "It would indeed be a miracle if studies of such crazy quilts (utility systems in Ohio) did not bring out many opportunities for substantial economies in the areas served." Cook's illustrations of past integrations not only prove that utilities have recognized these opportunities but that such combinations are carried out without governmental pressure.

Certainly the integration of Ohio Public Service Co with Ohio Edison Co is a good example of the potentialities in this field. The expansion of the American Gas & Electric System in Ohio and Indiana is another case used by Cook in justifying his proposal. Arizona, North Carolina, New Jersey, New York, and almost every other state in the union can provide a recent example of an economical integration of companies and systems. All of these business transactions were carried out in a free enterprise environment where private capital was risked for potential profit.

Right now utilities in all parts of the country are studying many more situations that will provide savings through combined operations. If such studies are brought to light, immediate changes take place in stock values, employees become worried over their future opportunities, and local politicians, citizens, and profiteers go into action. It is hard to see why publicity, called for in Section 30 of the Securities Act, can do anything more than delay or even block economic combinations. Should the SEC choose to assist in the studies and promotion of these plans on a confidential basis, it might well provide a constructive force in the field of utility integration.

However, we believe that in general free arms-length bargaining without government interference in matters of this kind will provide the most satisfactory solution. Why should we have an additional pressure from Washington on the little utility who wants to hold out against the big one? Smaller units have this advantage: They permit the top executives to maintain closer contacts with the communities and customers their companies serve.

We can also visualize the disruption of present intercompany co-operative programs and interconnections when absorption becomes a serious threat. Then the question of interference with state regulation presents another problem with which SEC would be faced.

Giving SEC full credit for its good intentions, we will have to be shown why it should take on the job of reshuffling utility systems.

Getting Out the Pennsylvania Vote

Pennsylvania Power & Light Co is one utility which is doing its share to get the voters to the polls in November. Twenty conference leaders, selected from among non-supervisory as well as supervisory employees, have been trained to conduct meetings using the Harding College plan entitled "The Power of Your Vote."

By Aug. 12 the conference leaders had conducted 119 employee meetings in the company's 9,500-sq-mile territory. Practically every one of the 6,500 employees attended one of these meetings on company time.

Collateral aids to the program consist of messages from Pres Charles E. Oakes, bulletin board posters, pamphlets, and discussions in various departments.

The company is now making the program available to outside groups. More than 25 presentations have been made to civic and service clubs. And the company is lending the script and flannel-board material to groups and training their representatives to spread the message of good citizenship. One organization has 40 meetings scheduled.

At right William McCulley, a company representative, is pictured making his presentation to the Lancaster Junior Chamber of Commerce which is working with the city's Register and Vote Committee.

There is still time for other utilities to follow this example.

Ash Handling and Disposal

Some attention is always given to handling and disposal of slag and ash when a plant is designed, but trends point to need for much more attention. Some operators even go so far as to say that the one really unsolved operating problem in the plant is that of coping with the non-combustible ingredient of the fuel. Nor is the task inside the furnace and in the tube banks the crux of the problem. In fact boiler and burner designs for control of combustion along with soot blowers have contributed to simplification of that segment of the task.

Such "beefing" as there is has swung toward the handling and disposal of the ash after it leaves the combustion area. Shall it be sluiced away or hoppered and hauled way? Where can it be deposited or who wants it? Has the ashhole already been filled far ahead of the estimated 20 or 25 year life when the site and initial plant capacity were fixed?

Some even shudder when they think ahead about the predicted tripling of peak load and the accompanying tripling of ash volume. This relation promises to hold because any further improvement in thermal efficiency bids fair to be countered to a considerable extent by a rise in load factor. Meanwhile, there is growing pressure to extract more of the ash within the plant and pass less to the atmosphere.

In short, the operators want the designers of future plants to give proportionally more thought to the day-in and day-out job of handling and disposing of increasing volumes of ash. They know the designers will be critical about the condensing water supply when the site is chosen. Nor have operators much worry about designers providing adequate facilities for handling and storing the coal. But they do wish they could have better assurance that new solutions will be devised to deal with what is left over after the coal has been burned.

Long-Range Fuel Planning

Probably few utilities worry much about the source of fuel over the whole life of a new power plant. That was not too serious an attitude when plants grew relatively slowly and there were alternative supplies usually in prospect. Growth now, however, is so rapid and the step-up in fuel consumption so lively that every plant should have a 20-year program of choices to fit any eventuality. Eventualities are certain if recent years have been any index of the future. Gas and oil have been increasingly available, but they, too, are subject to physical and human interruptions just as coal has been and promises to continue to be.

These interferences may be more frequent as these three fuel industries become conscious of the greatly increased dependence of an expanding utility industry on fuel. An estimate has been made and will shortly be published to show that the power companies will be burning 300 million tons of coal per year by 1970. Will the coal industry have miners or be mechanized enough for that added output? Will other users continue to shift to other fuels and release coal for power purposes? Will the gas and oil supplies meet those shifted demands indefinitely?

The issues are certain to persist. Designs will hardly be economical in the long run unless they have been made with possible emergencies considered. What those exigencies can be are just as important to estimate in detail as where the load will develop, how much it will total, and what will be its characteristics.

THE ELECTRICAL WEEK

The Issue's News Highlights—A last-minute change in sites by AEC on its Ohio gaseous diffusion plant has caused some delay in signing of a power supply contract with Ohio Valley Power Corp. Things are moving smoothly now, and agreement is expected in a week or two.

Alcan has spun the first unit of a 540,000-hp, twin-dam installation on the Peribonka River in Quebec. The new power will increase output of the company's Arvida smelters by about 50,000 tons a year.

Harrison Williams, utility financier, has won reversal of a $12-million judgment against him in a suit brought by trustees of the bankrupt Central States Electric Corp.

Latest from Washington—Group of Minnesota electric co-ops are discussing possibility of transmission loan with REA officials . . . Control agencies will not have an accurate picture of the effects of the steel strike on heavy equipment manufacture before September . . . Government personnel cuts are beginning to hit NPA electrical divisions. Electrical Equipment Division will let ten civil service workers go this month leaving only 61, and Engine and Turbine Division will let six go, leaving 40.

TVA is considering using 250,000-kw steam generating units for its Gallatine Plant . . . A new NPA direction seeks to reduce temporarily the permissible inventories of certain steel items held by electric utilities . . . Interior says it has not expressed the belief that Arizona is entitled to the Colorado River water it will need for the Central Arizona Project, although Interior has granted rights of way for one portion of the project (EW, Aug. 11, p 112) . . . Electric power needed for AEC expansion may cause some rather extensive shuffling of heavy equipment order boards.

Citizens Utilities Co, Greenwich, Conn., is acquiring electric facilities adjacent to its own system in northern Vermont. The company will purchase the electric properties of Blair Vermont Plywood Co for $65,000, which will add 600 kw to its hydro capacity. Citizens also will pay $200,000 for electric facilities of the village of Barton, Vt., including 1,400 kw in hydro capacity and transmission and distribution lines.

Consolidated Edison has put back in service a 160-Mw turbogenerator at its Hell Gate Station which came off the line last February. Repairs included rewinding and rebuilding of both the high pressure and low pressure generator and extensive work on the turbine.

Total steel production for the first seven months of 1952 was 46,637,256 tons, 14,351,224 tons less than in the same period of 1951. In the first quarter of this year production was running 1.5 million tons ahead.

Wisconsin Power & Light has asked FPC authority to merge all of the electric operating facilities of Nekoosa-Edwards Light & Power Co into its system. Wisconsin P&L proposes to pay $300,000 for the facilities, subject to certain adjustments.

Whatcom County PUD apparently is out of proposed joint purchase of Puget Sound P&L facilities by seven Washington PUD's. Whatcom, which has delayed its decision on whether or not to join the other six PUD's for some time, has hired consulting engineers to study the purchase but Puget Sound and fiscal agent for the six PUD's have refused to give them access to data on property valuation. The six PUD's are reported drawing up a new purchase plan.

Construction—Florida Power Corp reports that its 30,000-kw Swanee River steam plant scheduled for operation this December won't go on the line until April 1953 because of steel strike . . . Pennsylvania W&P has started preliminary work on expansion of its steam plant at Holtwood, Pa. The new addition will include a 66,000-kw turbogenerator and, according to Foster Wheeler Corp, the largest coal-fired anthracite steam boiler in the world. The boiler is rated at 700,000 lb per hr, 945 psi, 905 F.

Labor—Employees of Detroit Edison Co, members of Utility Workers Union of America, CIO, have taken a secret strike vote reported favoring a walkout by a 10-to-1 margin to bolster their bargaining demands. Contract which ran out July 31 has been extended to Aug. 31 . . . Vepco grants 1,200 workers an 8% pay boost effective Oct. 1.

Governor Williams of Michigan appoints a three-man fact-finding panel to settle labor dispute between Michigan G&E and CIO union at Ishpeming, Mich. . . . Public Service Co of Indiana and IBEW, AFL, sign two-year contract providing for 7% wage increase retroactive to May 1, and wage reopening talks May 1, 1953.

From the Southeast—Florida Power Corp reports that appliance dealer sales totaled $1.6 million in June 1952 compared with $800,000 a year ago . . . Tampa Electric completes second mercury-vapor, high-level 66-lumen series unit street lighting installation in Tampa.

Rates—Jamestown asks New York PSC approval to boost rates to residential users by 17.8%, all-purpose users 17%, and industrial users 20.81% . . . Those objecting to recent increase in commercial rates by Consolidated Edison have been given until Oct. 1 by New York PSC to file petitions for a rehearing of case.

Bureau of Reclamation is studying the possibility of creating a 65,000-acre irrigation project in Washington partially financed by power revenues from Chief Joseph project. Congress authorized the study this year, but legislation still is needed before any contruction work can begin.

Financial—Texas Utilities Co votes a dividend of 47¢ a share on common, payable Oct. 1, compared with 42¢ previously . . . Citizens Utilities will pay dividends quarterly instead of semi-annually beginning next year.

Ernest R. Acker, president of Central Hudson Gas & Electric, is chairman of an EEI committee to formulate plans for celebration of Diamond Jubilee of Light in 1954.

Obituary—Whipple Jacobs, president of Phelps Dodge Copper Products Corp since 1949, died Aug. 19.

WASHINGTON COMMENT

JESSE MOCK

With President Truman voluntarily demoting himself to a "buck private in the rear ranks" of the present Democratic campaign for the presidency, his Cabinet members and other subordinates are put at a very low level indeed.

This situation partially accounts for the relative calm that has descended over the federal agencies dealing with electric power. Practically no controversial power matter has arisen within the federal government during the past six weeks or two months. It is enough to make electric utility men—both public and private—a little uneasy.

A Victory Would Be Job Insurance . . . The explanation boils down to this: Democrats who man the federal agencies are depending on another victory in November to help them retain their jobs. They are looking to their nominee, Gov Adlai Stevenson, to call the plays that will bring another Democratic triumph. Thus far he hasn't called any plays. Or if he has, they haven't involved controversial moves on the part of federal power agencies.

There is reason to believe that the new "buck private" and his subordinates are not entirely pleased with the slow start that Governor Stevenson is making. They want a little action of the 1948 variety and the sooner the better.

It becomes clearer, then, why Mr Truman dispatched a couple of his aides to Stevenson's Springfield camp when the governor visited Washington recently. It should be of particular interest that one of these aides is David Bell, who is one of the President's legmen on matters involving electric power.

Bell has been White House liaison man on the controversial water resources policy proposals which President Truman has promised to present to Congress. These proposals grew out of the report of the President's Water Resources Policy Commission which called for comprehensive federal hydro-electric developments.

Stevenson's new helper also handled many of the White House assignments on the St. Lawrence Seaway Project during the past year. This has involved keeping an eye on Congressional developments and negotiations with Canada on the power facilities connected with the proposed seaway.

Power Issue Could Make Campaign Fodder . . . If the Washington-Springfield liaison works smoothly, it may be that some of the federal agencies will begin swinging into action soon to help provide campaign fodder for Stevenson. Whether power development becomes even a secondary issue may well depend on actions taken by federal agencies between now and November.

Things were different in 1948. With Truman the nominee, he called a special session of Congress and among other things asked for money to begin the New Johnsonville steam plant of the Tennessee Valley Authority. He also asked for $32 million for Army Corps of Engineers projects, many of them involving hydro-electric facilities.

Looking back on the 1948 campaign, one recalls that nearly all of the federal agencies were trying to get in on the act—or at least their actions had election-year significance. The Bureau of Reclamation was hollering for more money for projects then underway. Rural Electrification Administration was negotiating a large controversial loan to a South Carolina transmission cooperative. Southwestern Power Administration was negotiating power contracts with preferred customers. Federal Power Commission began working off a number of rate increase applications made by electric utilities. And President Truman was in no mood to compromise on federal construction of St. Lawrence power facilities.

Judging by past performance, the present calm in Washington is temporary.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Grounded distribution systems are more vulnerable to lightning and wind than the ungrounded. Ratio of faults more than 2/1.

Power plant noise usually falls between 80 and 120 decibels above the accepted threshold of 10-16 watts per sq cm.

Excess voltages, both 60 cycle and impulse, are proving lower than was assumed when basic insulation levels were set. Standards can be lowered to reflect substantiating experience, particularly with today's dependability of arresters.

Contact with de-energized (but normally energized) conductor while simultaneously in contact with grounded conductor is a case of inviting a hazard. Do linemen understand why?

Cable-splicers seem to prefer using a nitrogen tank to test joints rather than a hand pump.

Gas recirculation can improve net heat rate by 2% when it is used to help maintain high reheat temperature with decreasing load.

Francis turbines are trending toward use for higher heads and toward increased specific speeds for given heads.

Germanium crystals are ineffective for transistor use unless the arsenic impurity is reduced to less than one part in 100 million. Irradiation permits such highly refined detection and measurement.

Main gas transmission pipelines in U. S. A. amount to 100,000 miles and require 3,500,000 horsepower of compressors for pumping. Power requirements will double in less than 20 years.

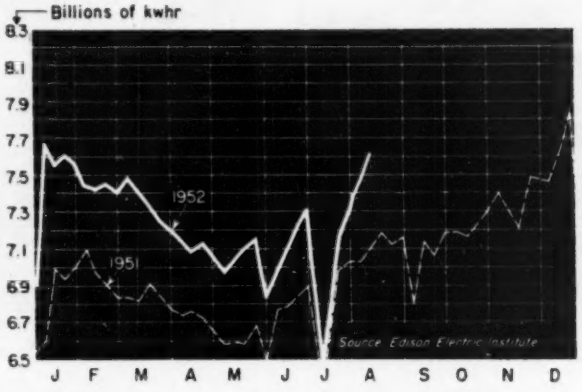
Voltage regulation is usually viewed from the angle of improved service. It offers benefits of revenue increase and system economy too often omitted from the figuring.

Spiral cases for Francis turbines when welded save about 14% in overall weight and 13% in total cost of the turbine.

Detector tuned to 2,000 cps will pick up slot discharges from generator coils but not be sensitive to the (higher) frequencies associated with ionization of the voids in the coil insulation.

Size and cost of a capacitor varies almost inversely with the square of the voltage strength of the dielectric between its conductive surfaces.

STATISTICS



Output Week Ended Aug. 16—7,626,608,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Aug. 16	+6.5	+5.9	+1.8	+2.5	+10.7	+15.5	+11.4	+9.3	+1.4	+5.0
Aug. 9	+6.0	+6.1	+3.1	+1.3	+7.4	+13.3	+8.7	+12.4	+1.1	+7.9
Aug. 2	+5.7	+5.4	+2.5	−1.7	+6.1	+15.2	+16.3	+7.9	+2.4	+6.0

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Loads (Million Kw)	June	67.0*	65.9	62.4
Capacity (Million Kw)	June	77.46	77.01	72.30
Production (Billion Kwhr)	June	31.53	31.82	29.84
Hydro		9.16	9.69	8.02
Fuel		22.37	22.13	21.82
Fuel Consumption				
Coal (Million Tons)	June	7.66	8.01	8.06
Oil (Million Barrels)		3.91	3.72	4.54
Gas (Billion Cu Ft)		89.29	76.99	75.42
Sales (Billion Kwhr)	May	27.94	28.33	26.35
Residential		7.52	7.91	6.68
Commercial		4.74	4.74	4.34
Industrial		13.83	13.85	13.42
Other		1.86	1.83	1.90
Net Income Class A & B Companies ($ Million)	June	69.83	68.24	62.63
Estimated Dec. 52 Peak (Million Kw)	May	80.0	80.2	78.8
Kwhr per Residential Customer (12 Month Average)	May	2,078	2,066	1,909
Revenue per Kwhr Residential Service (12 Month Average)	May	2.78¢	2.79¢	2.85¢
Canadian Production (Billion Kwhr)	May	5.33	5.03	5.13

Business Statistics

FRB Industrial Production Index†††	June	204	212	223
Gross National Product Annual Rate ($ Billion)	1stQtr.	339.7	334.6	319.5
E. W. 5 Industry Production Index	June	96.9*	116.0	123.2
ENR Construction Cost Index††	Aug.	122.7	119.6	113.8
BLS Consumer's Price Index	June	189.6	189.0	185.2
NEMA Insulation Materials, Sales Index†	May	517	545	614
NEMA Electric Appliance Sales Index†	May	219	221	296
NEMA Household Refrig. Sales Index†	May	132	133	183
Metal Prices (Aug. 18)				
Copper, Conn. V., lb		$ .24½	$ .24½	$ .24½
Lead, N. Y., lb		.16	.16	.17
Zinc, prime Western E. St. Louis, lb		.14	.15	.17½
Tin, Straits, qual. N. Y., lb		1.21½	1.21½	1.03
Aluminum, ingot, base price		.20	.19	.19
Nickel, base price		.56½	.56½	.56½
Steel, billets, Pitts., ton		59.00	56.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Estimated. † 1936=100 †† 1949=100 ††† 1937-39=100 (Unadjusted)

'52 Utility Construction Now Over $738 Million

Construction by privately owned electric utilities totaled $738 million during the first half of 1952.

This estimate, prepared by the Department of Commerce, includes the erection, maintenance, and repair of immobile structures together with service facilities which become integral parts of structures and are essential to their use for any general purpose. It includes construction with REA funds.

This estimate does not include turbines, generators, switchgear and their installation.

It does include, however, both underground and overhead transmission and distribution lines.

The department estimated, shortly before the steel strike, that during 1952 outlays for all types new construction would set a new record of over $32 billion.

Estimated New Construction Activity
(Millions of Dollars)

	1951	1952	% change
Private, total	$1,684	$1,525	−9
Residential	10,973	10,850	−1
Nonresidential	5,152	4,680	−9
Farm	1,800	1,700	−6
Utility	3,695	3,925	+6
All other private	64	70	+9
Public, total	9,341	10,950	+17
Residential	595	725	+22
Nonresidential	3,471	4,000	+15
Military	1,019	1,900	+86
Highway	2,400	2,500	+4
Sewer and water	706	700	−1
Public service enterprises	213	200	−6
Conservation and development	860	850	−1
All other public	77	75	−3
Total New Construction	$1,025	$2,175	+4

At that time volume of new construction by electric companies was expected to reach $1,640 million. This would be a 24% increase over the $1,319 million of new construction added during 1951.

Privately Owned Utility Construction
(Millions of Dollars)

	1951	1952	% change
Electric	1,319	1,640	+24
Railroad	399	400	—
Telephone & telegraph	487	550	+13
Other	1,490	1,335	−10
Total	3,695	3,925	+6

Confusion resulting from the steel strike and the resulting shortages have made it impossible to revise this estimate. NPA officials do, however, generally foresee no serious drop in the volume of construction activity scheduled for this year. But scheduling is one thing; construction is another. There is no doubt that the strike has delayed many jobs.

The government has picked the place* . . . . . and the executives who will direct construction of the Ohio gaseous diffusion plant. A 15-company group will supply all the power. And in Washington, an . . .**

AEC Pact Is Near After a Site Delay

A last minute shift by Atomic Energy Commission in choosing the site for its Ohio Valley gaseous diffusion plant has slowed negotiations for electric power to supply the new installation.

However, AEC negotiators still expect the contract with the 15-company Ohio Valley Power Corp will be ready for signing within a week or two. It is contemplated that the company will supply the entire 1.8 million-kw capacity needed to meet the AEC load.

Preliminary negotiations between AEC and the power corporation were based on the assumption that the AEC plant would be about 15 miles above Cincinnati on the Ohio River. When AEC picked the site on the Scioto River in Pike County, the company wanted to take another look at its plans to supply the diffusion plant from two power stations it had tentatively planned to build on the Ohio River. The larger of these plants was slated to be built in southeastern Indiana near the Kentucky and Ohio borders. The smaller was to be built in the Portsmouth, Ohio, area.

AEC Secrecy . . . In announcing the Pike County site, AEC did not explain why previously considered sites had not been chosen. Because of possible real estate exploitation, AEC kept its site plans a secret until it made the final announcement early this month (EW, Aug. 18, p 10).

Company spokesmen were not prepared last week to say whether the shift of the AEC site would also mean a shift of the power plant sites. One engineering source intimately familiar with the situation opined there would be no substantial change in the company's general construction plans.

Barring changes in engineering plans, the Ohio Valley Power Corp generating plants will stack up something like this:

Largest will be in southeast Indiana on the Ohio River. It will have seven 200,000-kw steam turbine generators. Total capacity of 1.4 million kw will be second in size only to TVA's Shawnee Plant, which will be expended to more than 1.5 million kw.

AG&E Action . . . American Gas & Electric Service Corp is to build the Indiana plant for Ohio Valley Power Corp. It will be enclosed in accordance with most of the generating plant structures of American Gas & Electric Co subsidiaries.

The plant to be built on the Ohio near Portsmouth is to have an installed capacity of 800,000 kw, which means it will have four 200,000-kw steam turbine generators. It is believed Ebasco Services, Inc, will build this plant, using semi-outdoor construction such as it is now using at Joppa.

Turbo-generator units will be of conventional design and are to be built by Westinghouse Electric Corp and General Electric Co. Combustion Engineering-Superheater, Inc, and Babcock & Wilcox Co are to supply the boilers. Just how many units each of these four companies are to furnish could not be determined last week, although order board space has tentatively been allotted for the huge equipment.

High Voltage Lines . . . Primary transmission between the two power plants and the AEC plant will be 330 kv. It is expected that at least a part of the interim power, which the 15-company group will furnish AEC pending completion of the two plants, will be transmitted on 330 kv lines now operated by American Gas & Electric. Other interim power will probably be supplied over conventional 230 kv lines.

Most of the generating capacity

* **THE PLACE:** Lone business establishment in Sargents, Ohio, is at the center of AEC's prospective gaseous diffusion plant. U. S. Route 23 is shown in the foreground.

** **THE MEN:** Gordon Molesworth, manager at Oak Ridge atomic energy project, talks over plans for the new plant with Kenneth Dunbar, manager of the Ohio project.

from the two new plants is expected to come on the line in 1955, but a part of it will not be on before 1956. If there should be conflicts in scheduling the production of heavy equipment, the Ohio Valley plants will probably have to take a back seat to expansion of power plants to serve the AEC Oak Ridge and Paducah installations.

There was at least one other hurdle to clear before construction can get under way on the power plants. Securities and Exchange Commission, which has jurisdiction over corporate structure and financing of the Ohio Valley Power Corp, must give its consent to the venture. However, SEC previously cleared the way for organizing and financing Electric Energy, Inc, which is similar in structure to the Ohio corporation. EEInc is to supply power for the Paducah, Ky., AEC gaseous diffusion plant.

Fairly Certain . . . There is every indication that SEC will also consent to the plan of the Ohio company and postpone till more normal times the gathering of extensive evidence required by the Holding Company Act.

The two large power plants, costing about $400 million, will be about 95% debt-financed, largely through loans from insurance companies. Common stock would be held by the 15 companies which will construct and operate the generating facilities. It is understood that interest rate on the loans will probably be about 3½%.

FPC Publishes 3 Maps Showing Power Facilities

Three new maps showing principal electric facilities in South Carolina, Wisconsin, and in the Maryland-Delaware-District of Columbia area have been published by Federal Power Commission.

The commission already has published maps of electric facilities in 19 other states. All the maps are reproduced in several colors on a scale of 20 miles to the inch, and are approximately 21 by 28 in. in size.

Copies of the state maps may be purchased from the Publications Division, Federal Power Commission, Washington, 25, D. C. for $1 each. Order numbers are M-33 for the South Carolina map; M-34 for Wisconsin; and M-35 for Maryland-Delaware-District of Columbia.

DPA Pushing Plant Dispersion

Agency requires utilities to submit statement on plant distribution as part of application for rapid tax amortization

Defense Production Administration is using its rapid tax amortization program to help push industrial dispersion of electric utility projects.

Since early August, DPA has required utilities to submit a statement on dispersion as a part of each application for rapid tax amortization. This statement, known as Appendix B, must be signed by the local industrial dispersion organization. It is designed to furnish DPA with information needed to enable it to determine in what manner the national dispersion criteria are being met by construction of the new facility. If there is no local dispersion organization, the applicant must supply certain data on the Appendix B form furnished by DPA.

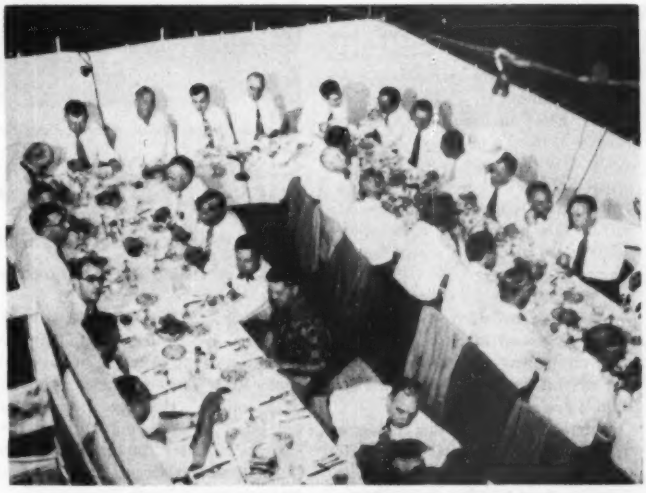
Other Applications . . . The new requirement also applies to facilities for which a company is asking reconsideration of its tax amortization application after once having been denied amortization. Appendix B also must be filed by utilities requesting an extension of time within which to begin construction of facilities for which rapid tax amortization has been granted.

Appendix B is required to be filed only if the cost of the facility is estimated at $1 million or more.

To permit expeditious analysis of applications, the customary application form (DPAF-2) and any requests for reconsideration or extension of time may be filed with a statement that appendix will be submitted to DPA not more than 30 days later.

DPA will not issue a certificate until Appendix B has been received.

Handbook Available . . . There has been no change in procedure for submitting the applications except for the addition of Appendix B. For further information about the national indus-



They Ate a Dubuque Boiler Dinner

Dubuque and East Dubuque (Ia.) City Councilmen were put in a boiler recently by Interstate Power Co and served shrimp dinners. Better now than in the fall, when the dining area will be a warm 2,400 deg F. That's after the 25,000-kw addition Interstate's publicity men were dramatizing goes on the line. Inside the new boiler in the Dubuque Plant wasn't such a bad place to be when the picture was taken: engineers had rigged a platform for the tables, leaving space underneath for half a ton of ice.

trial dispersion program, Defense Electric Power Administration suggests utilities refer to a handbook published by the Commerce Department. Titled "Industrial Dispersion Guidebook for Communities" (Domestic Commerce Series No. 31, U. S. Department of Commerce), the pamphlet may be purchased for 20¢ from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

PUD Stakes Claim

Asks FPC for permit at Priest Rapids, Wash., although Corps plans to build there

A Washington public utility district has indicated it is interested in building the $250-million Priest Rapids Hydroelectric Project even though Congress has authorized its construction by the Army Corps of Engineers.

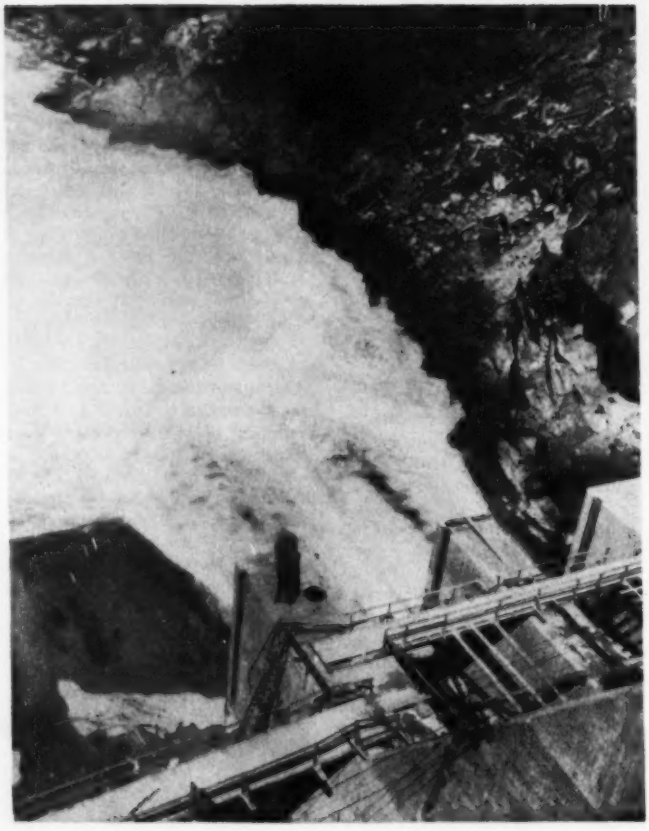
Public Utility District No. 2 of Grant County, Wash., has applied to Federal Power Commission for a 24-month preliminary permit for the huge Columbia River project. If granted the permit would merely give the holder priority at the site while conducting surveys and investigations necessary to prepare an application for an FPC license.

The PUD application is unusual because other public agencies generally stick to a "hands-off" policy on projects authorized by Congress. However, before federal construction can get underway Congress must appropriate funds specifically earmarked for the project.

FPC has made no decision on the application, and even if the permit should be issued there is no commitment on the part of FPC that a license can or will be granted for the Priest Rapids Project.

Federal construction was authorized by Congress in the Flood Control Act of 1950. There appears to be a legal question as to whether the authorization precludes any non-federal agency from development of the site.

In its application, the PUD proposed that power developed at Priest Rapids be used to supply requirements of agricultural and industrial development in the Columbia Basin Irrigation Project now being constructed by Bureau of Reclamation.



Chute-du-Diable Dam, under construction on Peribonka River in Quebec, discharges water from . . .

First of 10 New Alcan Units

When completed, 540,000-hp hydro installation will boost output of company's Saguenay system by 25%

Aluminum Co of Canada last week spun the first of ten new 54,000-hp generators being installed on the Peribonka River about 400 miles northeast of Montreal. The new installations will boost by 25% output from the Saguenay Valley power system in Quebec, second largest hydroelectric development in North America.

The Peribonka (river that digs a bed in the sand) plunges down 200 miles from its headquarters above the 50th parallel into Lake St. John, from which the Saguenay flows into the St. Lawrence.

Alcan is the world's largest and lowest-cost producer of primary aluminum ingot. It owns the Saguenay system with its parent company, Aluminum Ltd, Montreal.

New power from the Peribonka will enable Alcan to run its four Quebec aluminum smelters at full capacity (496,000 tons) this year for the first time without buying outside power. It is expected that total capacity will be boosted to 550,000 tons in 1953.

Twin Sites . . . Five of the new generators are at Chute-du-Diable, where construction began in November 1950; the others, 14 miles downstream at Chute-a-la-Savane, begun May 1951. Electricity will start flowing from Chute-du-Diable's four other generators at three-week intervals.

Savane will deliver power early next year.

The new generators are not housed in conventional buildings. They are being lowered into the concrete of the dams themselves. Chute-du-Diable required excavation of 673,000 cu yd of rock and the pouring of 343,000 cu yd of concrete.

At Savane, 535,000 cu yd of rock were dug out and 391,000 cu yd of concrete poured.

Big Gang . . . Seven thousand workmen were employed to build the two power projects. A 25-mile highway had to be built through timber-studded country from the nearest village to the dam sites. Then an entire community was erected for the construction gangs.

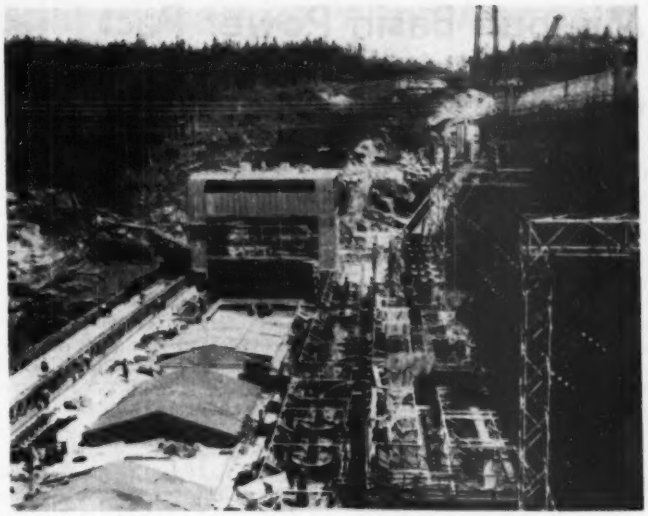
Work goes on around the clock throughout the year, though winter temperatures on the Peribonka drop to 40 deg below zero.

Cost of Alcan's power expansion in the Saguenay Valley is about $120 million. Primarily because it generates its own electricity, Alcan's aluminum production costs are from 2 to 4¢ a pound below those of Alcoa, Kaiser, and Reynolds. It takes nearly 10 kwhr to make one pound of aluminum. Saguenay power costs Alcan slightly less than one mill per kwhr. U. S. aluminum producers' costs are two to four times as high.

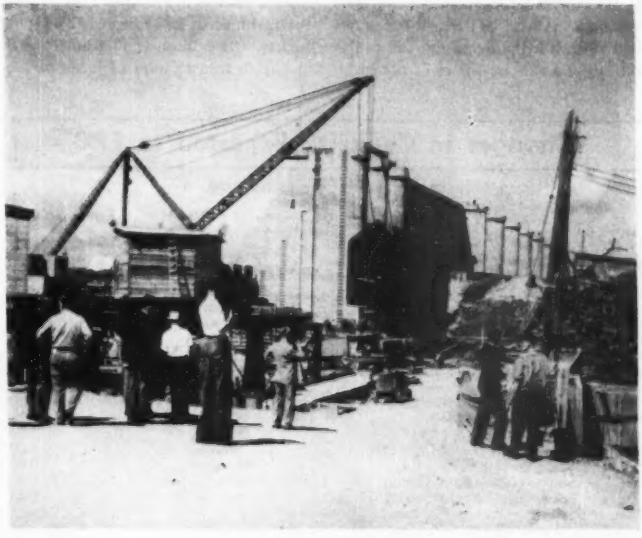
Sells Some . . . Alcan now sells about 15% of its Saguenay power output. The Saguenay system includes five dams and three powerhouses: Isle Maligne, built in 1925 with a capacity of 540,000 hp; Shipshaw No. 1 in 1932, 300,000 hp; Shipshaw No. 2 in 1943, 1.2 million hp.

The two new Peribonka plants will put power into the network that supplies the company's smelter at Arvida, Quebec, largest in the world. The smelter is an important source of aluminum ingot for the United States. Last year this country imported more than 100,000 tons of Canadian Aluminum.

Bauxite for the Arvida plant is unloaded from ships at Port Alfred, 30 miles east of Arvida. The ore is then chemically processed at the sprawling plant to give alumina. Usually four pounds of bauxite yield two pounds of alumina. This combined with other minor substances and "treated" with 10 kwhr of electricity, produces one pound of aluminum.



From Chute-du-Diable the water flows...



. . . to make power at Chute-a-la Savane

Powerhouse and transformer section of Aluminum Co of Canada's Chute-du-Diable hydroelectric development on the Peribonka River, Quebec, is shown under construction in the upper picture. One of this plant's five 54,000-kw generators was placed on the line recently at a special ceremony attended by officials and newspaper men.

In the lower picture, the newspaper group gets its first look at a sister dam at Chute-a-la-Savane, downstream from Chute-du-Diable. Each project will have an eventual capacity of 270,000 kw. This will be added to the 2.1 million kw in Alcan-Aluminum Ltd's Saguenay system supplying power to aluminum smelters in the district.

Missouri Basin Power Pact

Consumers Public Power District signs ten-year contract with Reclamation for delivery of energy from federal projects

Consumers Public Power District of Columbus, Neb., has signed a ten-year contract with Bureau of Reclamation under which the federal agency will furnish electric power from the Missouri River Basin federal power system.

The contract is the first to be executed in the state by the Bureau of Reclamation for delivery of Missouri Basin power. Two others are being negotiated—one with Omaha Public Power District and one with Nebraska Public Power System.

Consumers PPD and Reclamation also agreed on terms for making their transmission facilities available to each other. Consumers serves an area in the western part of Nebraska.

Rates . . . Under the contract executed with the power district, the bureau will furnish hydroelectric power to the district at a rate of 4½ mills per kwhr for the first 250 kwhr of energy per kw of maximum demand and 4 mills per kwhr for the balance.

There will also be a charge of $1 per kw of demand for firm power. Dump energy will be billed at a rate per kwhr equal to 90% of the average cost of fuel per kwhr replaced in the generating stations of the Consumers system by such dump energy.

The contract provides that 13,000 kw of power, of which 4,000 would be firm power, will be delivered to the district during 1953. Until that time, 9,000 kw of secondary energy will be furnished by federal government plants.

Transmission Accord . . . Consumers agreed to grant the federal government a license to transmit energy over the facilities of its system at 33 kv or higher. The license is limited primarily to transmission of loads of the federal government and preference customers, except municipalities. Payment is to be made at the rate of 7 mill per kwhr transmitted, plus 6% for losses.

At the same time, the federal government grants the district a license under the contract to transmit power over federal lines in the district's service area. Rates are the same as those charged by the district, and Consumers may transmit power only to its customers or to other parts of its system.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING JUNE

State	Utility	Plant	Fuel	Capacity (Kw)
N. Y.	New York State Electric & Gas Corp.	Hickling	S	50,000
Ohio	Cincinnati Gas & Electric Co.	W. C. Beckjord	S	100,000
Ind.	Kendallville Light & Water Department	Kendallville	S	6,000
Ind.	Bluffton Light & Water Department	Bluffton	IC	2,500
Ill.	Farmer City Municipal Power & Light Dept.	Farmer City	IC	1,136
Mich.	Wolverine Electric Cooperative	Johnson	IC	2,500
Mich.	Thumb Electric Cooperative of Michigan	Caro	IC	1,313
Mich.	Wisconsin Michigan Power Co.	Lower Point	H	100
Wis.	Columbus Water & Light Department	Columbus	IC	400
S. D.	Northern States Power Co.	Mobile Unit	IC	760
Kan.	Kansas Gas & Electric Co.	Murray Gill	S	40,000
Kan.	Winfield Light & Power Department	Winfield	S	5,000
N. C.	Carolina Power & Light Co.	Goldsboro	S	68,500
Miss.	Clarksdale Water & Light Department	Clarksdale	S	7,500
Tex.	Texas Electric Service Co.	Morgan Creek	S	40,000
Tex.	Southwestern Gas & Electric Co.	Knox Lee	S	30,000
Tex.	Southwestern Public Service Co.	Plant X	S	40,000
Ariz.	Salt River Project Agricultural Improvement & Power District	Kyrene	S	30,000
Utah	Murray City Power Plant Corp.	Murray	IC	2,200
Ore.	California-Oregon Power Co.	Fish Creek	H	11,000
Calif.	California Electric Power Co.	Highgrove	S	30,000

PLANT RETIREMENTS DURING JUNE

N. H.	Public Service Co. of New Hampshire	Sunapee	IC	1,000
Pa.	Pennsylvania Electric Co.	Vine Street	S	1,000
Ohio	Ohio Power Co.	Cranberry	S	500
Ohio	Ohio Power Co.	Sycamore	S	650
Ohio	Hiram Municipal Light Department	Hiram	IC	20
Ind.	Bluffton Light & Water Department	Bluffton	S	3,500
Iowa	Grand Junction Municipal Light Department	Grand Junction	IC	155
N. D.	Northern States Power Co.	Mobile Unit	IC	760

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of July 1—Hydro, 19,179,442 kw; Internal Combustion, 2,013,000 kw; Steam, 55,978,868 kw; Total, 77,171,310 kw.

Adlai on Power

Stevenson reveals an inclination to approve public development in letter to Oregon paper

Gov Adlai E. Stevenson of Illinois, Democratic candidate for President, recently made his feelings toward federal power a little clearer. In a letter answering questions put to him by the "Oregon Journal," he indicated his attitude was favorable although he admitted he did not have enough facts to form a conclusive opinion.

Here is what Stevenson said:

"As to public power, I have heard much of the situation in the Northwest and the controversy about the administrative machinery. I confess I have no conclusive opinion because I have never had occasion to gather the information on which it should rest. It seemed to me during my visit last spring that the situation was going along well in Oregon, and under thrifty administrative direction.

"This is one controversy where I need more education in order to work out a sound principle I can follow with confidence.

"What impressed me most of all about power development is the change of attitude and the disappearing resistance to such 'socialistic schemes.' I gather that even the private power people are glad to have public power now and the clamors seem to be for more and more of it."

Sen John Pastore Named to Atomic Energy Group

Newest member of the Joint Congressional Committee on Atomic Energy is 45-year-old Democratic Sen John O. Pastore of Rhode Island.

He was recently appointed by Vice President Alben W. Barkley to fill the vacancy created by the death of Chairman Brien McMahon. Before coming to the Senate in 1950, Pastore served his state as Governor and Congressman.

Democratic Rep Carl T. Durham of North Carolina is acting chairman of the committee and will presumably remain in that position until the 83rd Congress is organized next year.

Pacific G&E Asked to Wheel CVP Power

Under the terms of its wheeling contract with Pacific Gas & Electric Co, Bureau of Reclamation has asked PG&E to deliver Central Valley Project power to the Sacramento Municipal Utility District and four other potential preference customers.

Others listed were Ames Laboratory, Moffett Field, Provident Irrigation District in Glenn and Colusa Counties; Plumas-Sierra (REA); and Alpaugh Irrigation District in Kern and Tulare Counties.

PG&E, which has 90 days to declare whether it will wheel the power, has not answered the request, except in the case of the Provident Irrigation District which has just signed a ten-year contract with the bureau. PG&E told the bureau it will wheel the power if the irrigation district requests it. The district has been one of PG&E's customers for over a year. PG&E is agreeable to start wheeling CVP power on the effective date of cancellation of its contract with the district.

A joint irrigation district-bureau announcement said under terms of the contract the district will save more than 50% in its pumping bills.

The power company will receive for use of its facilities 1 mill for each kwhr of energy delivered, plus 5% lost in transmission. The payoff is in power fed from CVP's Shasta and Keswick system into the company's lines.

PG&E will receive from the irrigation district distribution and substation charges amounting to 22¢ per kw of demand, plus 4½% for line loss.

Under a new policy, the bureau will absorb the line losses in transmission of power from Shasta to the irrigation district's pumping station at Sidd's landing on the Sacramento River, a distance of some 100 miles.

Utility Financier Wins Appeal

Judgment of $12 million against Harrison Williams is reversed. Trustees plan to take case to Supreme Court.

Attorneys representing the trustees of Central States Electric Corp will appeal to the Supreme Court a court decision reversing a $12-million judgment against Harrison Williams, utilities financier.

The trustees, Carl J. Austrian and Robert C. Butcher, were granted the award last January by a federal judge but it was set aside last week by U. S. District Court of Appeals on the grounds that Williams could not be prosecuted because of the statute of limitations.

Suit Instituted in 1945 . . . The suit against Williams was begun in 1945 at the court's direction in behalf of the corporation, a business investment firm incorporated in Virginia and a key company in Williams' utilities empire. It went bankrupt in 1942.

The trustees charged that Williams, as principal stockholder, dominated and controlled the company's board of directors for his own interests. He was accused of using his influence in 15 transactions between 1927 and 1929 in a "breach of fiduciary duty." In 1929 the company had a valuation of $400 million which dropped to $1.3 million in 1942.

Cleared of 8 Charges . . . Williams was cleared of eight charges of "looting" but was ordered by the federal court to pay $12 million plus interest dating back to 1927, which would have more than doubled the award.

In reversing the decision, the Court of Appeals directed that the suit be dismissed. The court ruled New York State law prevailed and the statute of limitations was set at ten years.

First Reddy Kilowatt Farm Dedicated

Nation's first Reddy Kilowatt all-electric farm was dedicated this month by Pennsylvania Power & Light Co. On hand at ceremonies at the farm, owned by Ernest E. Ritter of Snyder County, were several leading electric industry figures. Among them was Ashton Collins, "father" of Reddy Kilowatt, who unveiled the first Reddy Kilowatt farm sign. Others in the above picture are Mr and Mrs Ritter, at right, and R. A. Jones, manager of PP&L's farm sales department.

FINANCIAL

WWP Board Set to Operate

Securities and Exchange Commission releases jurisdiction over selection of directors without displacing Rodney Aller

An independent Washington Water Power Co was all set to go into operation last week after Securities and Exchange Commission released its jurisdiction over selection of the nine-man board of directors.

Initial board of directors for the independent company was proposed by American Power & Light Co, which until last week held all of the stock of WWP. Distribution of the stock was scheduled to begin Aug. 21, and thereafter American shareholders will acquire WWP stock in proportion to their American holdings.

New Board . . . Included on the new board of directors for Washington Water Power are:

Kinsey M. Robinson, president of WWP; J. E. E. Royer, vice president and general manager of WWP; John J. Burke, president of the Metals Bank & Trust Co of Butte, Mont.; James A. Poore, Jr, attorney, Butte, Mont.; Howard C. Paulsen, secretary, Paulsen Estate, Inc, of Spokane, Wash.; Rodney G. Aller, attorney of Lakeville, Conn.; Albert Y. Bingham, vice president, Chicago Title & Trust Co of Chicago; J. Neil Smith, vice president of United Funds Inc of Kansas City, Mo.; and Raymond Enloe, president of Idaho Portland Cement Co of Spokane, Wash.

This initial board of directors, under the American P&L dissolution plan already approved by the courts, will serve until their successors are elected at the first annual meeting of the WWP stockholders.

Protest Set Aside . . . SEC reported it had received a protest from Idaho's Attorney General Robert E. Smylie against seating Rodney G. Aller on the initial board. This board member is son of Howard Aller, president of AP&L. Smylie argued that the American-WWP relationship should be dissolved in fact as well as in name, and that the younger Aller would represent a link with American's management. SEC, however, released its jurisdiction over selection of the board without displacing Rodney Aller.

Earnings, Money Cost Linked

Commenting on an 8¢ per share gain in the second 1952 quarterly earnings of Public Service Co of New Hampshire common stock, A. R. Schiller, president, said that since World War II more than $47 million has been spent by that company with a large part being financed by stocks and bonds at relatively high cost.

He said that the earnings have been on the low side for so long that the credit of the company has been affected. This may not sound very serious to the consumer of electricty, he declared, but "that is only because of his failure to realize the effect of low earnings on his cost of service." With earnings down, he continued, the company has to pay higher interest and dividend rates for the money it must raise to build new power plants, lines, and other facilities. As the cost of new money goes up, he said, electric rates must go up.

Schiller said that good water supply to hydro plants in the first half of 1952 is a substantial factor in the 8¢ per share increase in earnings. The remainder can be attributed to increases in rates totaling $1,944,750 allowed in the past 30 months by the New Hampshire Public Service Commission, but $641,000 of this has been appealed to the State Supreme Court and is subject to repayment if found excessive.

He pointed out that it will be necessary to improve the earnings still more in order to keep the cost of new money at reasonable levels. During the next four years, he said, the company will spend over $40 million for additional facilities. It is vital from the viewpoint of consumers and present investors that the financing of this large construction program be done at reasonable interest and dividend rates, he concluded.

FINANCIAL BRIEFS

"We're sold on Florida as a year-round state with a well-balanced economy!" That's the opinion of the nation's top investment bankers, according to William J. Clapp, president of Florida Power Corp, who recently conducted a series of conferences with financial men in New York City, Philadelphia, Chicago, and Boston.

I-T-E Circuit Breaker Co will pay Sept. 2 a common stock dividend of 56¼¢ per share as compared with 50¢ a share in the two preceding quarters.

REGULATION

Central Illinois Public Service Co has received Illinois Commerce Commission approval to sell energy wholesale to Greenup. Service will not begin for about a year, since Greenup must build a substation to receive the energy and plans to rebuild and increase the capacity of its distribution facilities.

Illinois Power Co has received Illinois Commerce Commission approval of a contract to provide Farmers Mutual Electric Co with electricity for resale. The REA financial system currently is receiving its power from Geneso.

Federal Power Commission has suspended a proposed $307,200 (about 13%) annual increase in rates by Cincinnati Gas & Electric Co to its subsidiary Union Heat, Light & Power Co, which was to have gone into effect Aug. 17. FPC will set hearing at a later date.

New Jersey Power & Light Co is planning to ask Public Utility Commission for a rate increase. The company's request for $975,000 a year rate hike had been previously turned down.

Tyre W. Burton has been named chairman of the Missouri Public Service Commission, succeeding Morris E. Osborn who resigned to enter his own law practice.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1952									
Aug. 14	**2.97**	**3.02**	**3.15**	**4.07**	**4.27**	**4.63**	**5.28**	**5.58**	**6.04**
Aug. 7	2.97	3.01	3.16	4.06	4.26	4.62	5.28	5.63	6.15
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47
4th 1951	3.02	3.07	3.21	4.32	4.50	4.91	5.42	6.18	6.84
3rd 1951	2.87	2.91	3.04	4.05	4.27	4.61	5.52	6.24	7.05

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
California Electric Power	12	June	$2,102,543	$1,616,026	$0.83(a)	$0.56(a)
Columbus & Southern Ohio Electric and subsidiary	12	June	4,133,165	3,683,469	2.16	1.91
El Paso Electric	12	June	1,471,377	1,401,824	1.84	1.75
Lake Superior District Power	12	June	929,984	807,787	.....	.....
Missouri Power & Light	12	June	1,149,709	1,199,446	.....	.....
Missouri Utilities	12	June	484,701	515,704	1.56	1.68
New York State Electric & Gas	12	June	7,209,676	5,688,847	2.30(b)	2.15(b)
North American	12	June	11,664,094	11,295,543	1.36	1.32
Northern States Power (Minn.)	12	June	10,719,102	9,791,533	0.96	0.88
Northern States Power (Wis.)	12	June	2,320,930	1,904,591	.....	.....
Northwestern Public Service	12	June	859,548	880,464	.....	.....
Pacific Power & Light	12	June	4,013,437	3,269,142	.....	.....
Pennsylvania Water & Power	6	June	740,362	611,147	1.33	1.29
Public Service Co of Indiana	12	June	9,321,304	8,230,235	2.39(c)	2.33(c)
Public Service of New Mexico	12	June	1,010,669	975,911	0.83	0.81
Rockland Light & Power	5	May	680,746	713,486	0.37	0.41
St. Joseph Light & Power	12	June	738,069	680,056	2.11	1.97
Western Light & Telephone	12	June	933,916	857,341	2.25(a)	2.10(a)

Notes—(a) Based on average number of shares outstanding; (b) Based on 2,696,950 shares in 1952 and 2,179,046 in 1951; (c) Based on 3,579,363 shares in 1952 and 3,207,155 shares in 1951; and (a) Based on 326,841 shares in 1952 and 312,264 shares in 1951.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public	Bid Date
WEEK OF AUGUST 14-20				
None Scheduled				
WEEK OF AUGUST 21-27				
None Scheduled				
SCHEDULED FOR SEPTEMBER TO DECEMBER				
Bonds				
Arkansas Power & Light—1st mtg 1982	$15,000	.....		Sept. 9
Central Illinois Public Service—1st mtg 1982	5,000	.....		*
Duquesne Light—1st mtg 1982	14,000	.....		Sept. 22
Appalachian Electric Power—1st mtg 1982	17,000	.....		Sept. 23
Washington Water Power—1st mtg 1982	30,000	.....		Sept. 30
California Oregon Power—1st mtg 1982	7,000	.....		#
Utah Power & Light—1st mtg 1982	10,000	.....		Oct. 15
Carolina Power & Light—1st mtg 1982	20,000	.....		Oct. 20
New Orleans Public Service—1st mtg 1982	6,000	.....		Dec. 15
Notes				
Appalachian Electric Power—serial 1956-1967	$6,000	.....		Sept. 23
Preferred Stock				
Duquesne Light—140,000 sh $50 par	7,000	.....		Sept. 15
Central Illinois Public Service—50,000 sh $100 par	$5,000	.....		*
Common Stock				
Utah Power & Light—167,500 sh (to be offered to stockholders on 1-for-10 basis, record Sept. 5 to expire Sept. 25; stockholders to be allowed over-subscription privileges)	$.....	.....		.....
California Oregon Power—250,000 sh	.....	.....		#
UNSCHEDULED AND UNDER CONSIDERATION				
Bonds				
Virginia Electric & Power—1st mtg 1982	$20,000	.....		.....
Mississippi Power & Light—1st mtg 1982	8,000	.....		.....
Central Hudson Gas & Electric—1st mtg 1982	5,500	.....		.....
Common Stock				
California Electric Power—354,610 sh	$.....	.....		.....

* Competitive bids will be opened during the week of Sept. 22. # Bids to be open during first two weeks of October.

CALENDAR

Institute of Radio Engineers
Joint Telemetering Conference with American Institute of Electrical Engineers, Lafayette Hotel, Long Beach, Calif., Aug. 26-27; Joint Computers Conference with AIEE, Park Sheraton Hotel, New York, Dec. 10-12.

Centennial of Engineering
Convocation, Chicago, Ill., Sept. 3-13.

***International Electrotechnical Commission**
Palace Hotel, Scheveningen, Netherlands, Sept. 3-13.

Michigan Municipal Utilities Association
Annual Convention, Charlevoix Beach Hotel, Charlevoix, Mich., Sept. 4-5.

Maryland Utilities Association
Cavalier Hotel, Virginia Beach, Va., Sept. 5-6.

Rocky Mountain Electrical League
Fall Convention, Colorado Hotel, Glenwood Springs, Colo., Sept. 7-10.

American Society of Mechanical Engineers
Fall Meeting, Sheraton Hotel, Chicago, Ill., Sept. 7-11.

American Standards Association
National Standardization Conference in conjunction with Centennial of Engineering, Museum of Science-Industry, Chicago, Ill., Sept. 8-10; 34th Annual Meeting, Waldorf-Astoria Hotel, New York, Nov. 19.

***Edison Electric Institute**
Area Development Institute, Yale University, New Haven, Conn., Sept. 8-10; Accident Prevention Committee, Sheraton Hotel, Rochester, N. Y., Sept. 15-16; Prime Movers Committee, Roosevelt Hotel, New Orleans, La., Oct. 6-7; AEIC joint meeting, Meter-Service Committees, Mayflower Hotel, Washington, D. C., Oct. 6-8; Electrical Equipment Committee, Roosevelt Hotel, New York, Oct. 13-14; Transmission - Distribution Committee, Hotel Adolphus, Dallas, Tex., Oct. 23-24.

Illuminating Engineering Society
National Technical Conference, Edgewater Beach Hotel, Chicago, Ill., Sept. 8-12.

Instrument Society of America
7th National Instrument Conference-Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 8-12.

National Association of Corrosion Engineers
Short Course on Corrosion in cooperation with Washington University, St. Louis, Mo., Sept. 8-12.

***American Society for Testing Materials**
Power Industry—Wood Symposiums in conjunction with Centennial of Engineering, Hotel Sherman, Chicago, Ill., Sept. 10-11.

Pennsylvania Electric Association
Annual Meeting, William Penn Hotel, Pittsburgh, Pa., Sept. 16-17; Fall Meeting, Electrical Equipment Committee, Irem Temple Country Club, Dallas, Pa., Oct. 2-3; Transmission - Distribution Committee, Penn-Alto Hotel, Altoona, Pa., Oct. 9-10; Fall Meeting, Systems Operation Committee, Hotel Roosevelt, Pittsburgh, Oct. 16-17; Industrial Committee, Bedford Springs Hotel, Bedford, Pa., Oct. 23; Fall Meeting, Meter Committee, Fort Stanwix Hotel, Johnstown, Pa., Oct. 23-24; Fall Meeting, Relay Committee, Robert Treat Hotel, Newark, N. J., Nov. 13-14.

Northwest Public Power Association
Accounting Section, Congress Hotel, Portland, Ore., Sept. 18-19.

Public Information Program
Annual Workship Conference, Edgewater Beach Hotel, Chicago, Ill., Sept. 18-19.

Missouri Valley Electric Association
Accounting Conference, Hotel President, Kansas City, Mo., Sept. 29-30; Sales-Rural Conference, Hotel President, Kansas City, Mo., Oct. 8-10.

***Addition this week.**

HERE'S WHERE YOUR MONEY GOES...
WITH SO MUCH MONEY NEEDED FOR DEFENSE, IT'S IMPORTANT THAT NONE OF YOUR TAX MONEY GOES FOR WASTEFUL, SOCIALISTIC PROJECTS. HERE ARE A FEW EXAMPLES OF GOVERNMENT SPENDING THAT IS UNNECESSARY...
BARRELS OF TAX MONEY—
OVER $ 350 MILLION WOULD BE NEEDED FOR THE POWER PLANT IT IS PROPOSED THE GOVERNMENT BUILD AT NIAGARA FALLS. FIVE LOCAL ELECTRIC COMPANIES HAVE OFFERED TO DO THE JOB WITHOUT SPENDING ONE CENT OF TAX MONEY.
PAYING THE BILL TWICE!
TWO COMPETING DEPARTMENTS OF THE GOVERNMENT EACH MADE COSTLY SURVEYS FOR THE SAME DAM IN HELLS CANYON, IDAHO. IN THE RECORDS OF FEDERAL BUREAUCRACIES, THERE ARE SCORES OF SUCH WASTEFUL DUPLICATIONS—AT YOUR EXPENSE.
DIG DEEPER! WHEN THE FEDERAL GOVERNMENT UNDERTAKES AN ELECTRIC POWER PROJECT THAT ELECTRIC COMPANIES COULD DO, YOU PAY TWICE — NOT ONLY FOR THE COST OF THE PROJECT BUT TO MAKE UP FOR LOCAL, STATE AND FEDERAL TAXES THAT ARE LOST.
$ MILLIONS!
YOU'LL PAY MILLIONS IN TAXES IF GOVERNMENT PLANS GO THROUGH TO BUILD POWER LINES IN THE SOUTHWEST THAT WOULD DUPLICATE EXISTING LINES OF LOCAL ELECTRIC COMPANIES WHICH CAN EASILY HANDLE THE ADDED POWER.
WHY BUILD TWO WHEN ONE WILL DO?
YOUR TAXES ARE HIGH ENOUGH ALREADY.
THEY WILL GO HIGHER IF THE GOVERNMENT TREND TOWARD SOCIALIZED ELECTRICITY CONTINUES. WE WANT YOU TO BE AWARE OF THIS DANGER. THAT'S WHY THIS MESSAGE IS BROUGHT TO YOU BY AMERICA'S
ELECTRIC LIGHT AND POWER COMPANIES*
* Names on request from this magazine

Here's Where Your Money Goes

This advertisement of the Electric Companies Advertising Program uses cartoon technique to tell the taxpayers how the federal government is wasting their tax money by duplicating facilities of the private companies or by building projects the private companies are willing to build. The ad will appear in national magazines in September.

5 Industries Will Join Freedom Celebration

Five industries will join the electric utility industry in celebrating Production for Freedom Week. Each will be featured on a radio program. The schedule of broadcasts follows:

Aug. 30—Mutual Network, 12:30 to 1 pm (EDST)—"The Extra Room," featuring the automobile industry. George W. Mason, president of the Automobile Manufacturers Association, will be guest speaker.

Aug. 31—250 independent stations —"Keep in Touch," featuring the communications industry. Mark R. Sullivan, president of the Pacific Telephone & Telegraph Co, will be guest speaker.

Sept. 6—NBC Network, 7:30 to 8 pm (EDST)—"Steel Yourself, Mr Hubbard," featuring the steel industry. Benjamin F. Fairless, chairman and president, United States Steel Corp, will speak.

Sept. 7—250 independent stations —"Black Gold," featuring the coal industry. Ralph C. Mulligan, director of public relations, Bituminous Coal Institute, will speak.

Sept. 13—ABC Network, 9:30 to 10 pm (EDST)—"Aviation." Donald W. Douglas, president, Douglas Aircraft Co, will speak.

Times for the programs broadcast from the 250 independent stations may be secured from local newspapers.

Freedom Production Theater TV Schedule

Coming attractions on the television show, "Production for Freedom Theater," include:

Aug. 31—"Magic Key." The Chamber of Commerce of the United States tells how advertising has helped spread labor-saving devices and comforts. And Dow Chemical Co tells about magnesium in "Treasure of the Sea."

Sept. 7—Douglas Aircraft Co presents "Operation Airborne" and "Skyrocket." These are stories of the C-124, giant cargo transport and the importance of electric power in their construction.

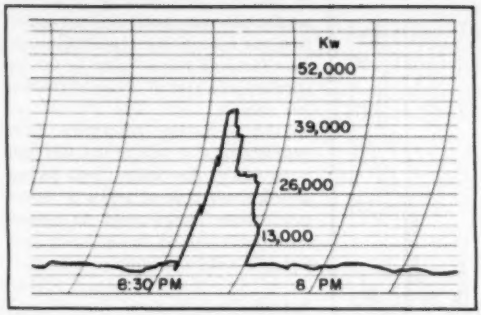
Sept. 14—General Electric Co presents "Freedom and Power," a story of the importance of the electrical industry.

No Kidding About Taxes

Latest booklet to bring out the dangers of high taxation by the federal government is "Let's Quit Kidding about Taxes." Author is Thomas G. Sabin, television producer-director and program consultant. The material originally appeared in "Pathfinder Magazine." Written in simple style the booklet gets added popular appeal from the pictures of babies, accompanied by clever captions, which illustrate it. Bozell & Jacobs, 2 W. 45th Street, New York 36, N. Y., can supply copies at 5¢ each in 1,000 lots.

'Meet Corliss Archer'

"Meet Corliss Archer," a program sponsored by the Electric Companies Advertising Program, will return to the ABC radio network on Friday, Oct. 3. The program will originate in Hollywood and will be broadcast from 9:30 to 10 pm (EDT). ECAP has sponsored this light comedy for a number of years.



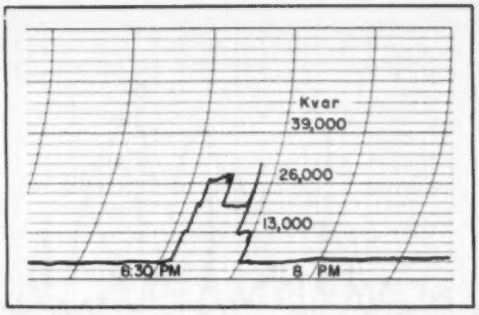


FIG 1-2—LOAD PICKUP TESTS during early operation of the tunnel produced these records. Maximum load pickup rate during tests was 4,100 kw per min; reactive about 2,700. Note steps in curves as each 29,000-hp motor goes on the line. Note also var surges on chart

How CEI Power System Handles 87,000-hp Wind Tunnel Load

Rapid pickup and shedding of load of three 29,000-hp induction motors driving supersonic wind tunnel produce serious swings in tie line load. Tests show no disturbance with pickup and shedding rate held to 5 Mw per minute

JOHN R. LINDERS, Supervising Engineer, Cleveland Electric Illuminating Co, Cleveland, Ohio

A new 87,000-hp supersonic wind tunnel, driven by three 29,000-hp induction motors on a single shaft, has been added to the facilities of the National Advisory Committee on Aeronautics at Cleveland used for research in aircraft propulsion.

Problems of picking up and dropping an induction motor load of this size and the effects of this load variation on the operation of the power system of Cleveland Electric Illuminating Co led to this special analysis of tie line load control requirements.

The entire 283,000-hp motor load at the NACA air lab develops a 2.0 diversity factor for a peak kilowatt demand to date of 103 Mw at about 0.9 power factor. Load factor is about 15%, and monthly energy use is between 10 million and 12 million kwhr.

Power system peak load of the CEI system is around 1,050 Mw; off-peak load is around 500 Mw, and monthly generation about 430 million kwhr. In other words, the NACA lab load has a peak demand of about 10% of the CEI system peak but uses only 2.5% of the energy generated. By coincidence this load demanded 2.5% of the company generation at one of the recent annual peaks.

The NACA facility is supplied by two 132-kv circuits on a steel tower line. In spite of the short distances involved, distribution of the power on the NACA property is at 34 kv. Protection on these 132-kv lines is by impedance relays for phase protection and by instantaneous directional ground relays for ground protection.

Original NACA load was primarily synchronous motors driving a complicated variable frequency drive system. This gave a very smooth load pickup with a readily controlled power factor. But the new supersonic tunnel with its three 29,000-hp induction motors on one shaft involved a very different load pickup problem.

Load should not be picked up faster than boilers will permit. Thus it is necessary that tie line load control facilities be able to follow, to some reasonable extent, the rapid pickup and drop-off of this large load. This demands a load control system that is capable of responding much more rapidly than is necessary for usual system requirements.

Initial System Tests . . . When this 87,00-hp tunnel was put on initial test, graphic records were made of watt and var conditions. Because of mechanical difficulties and electrical control problems, two of the test runs developed repetitive surges of 50,000 kw and 35,000 kw. The first group of surges of 50,000 kw occurred about 2:20 pm on a Sunday afternoon and caused 2 to 3½-v swings on our Clinton substation bus. The second group of surges of 35,000 kw at about 9 pm caused no appreciable voltage variation at Clinton. Generating plant voltages were not disturbed by these surges.

Four test start-ups were made. Load was picked up at various rates, the maximum being 4,100 kw per minute on the last run. The reactive was about 66% of this value. The shut-down period was too rapid for evaluation from the graphic records, but a typical graphic record of these tests is shown in Fig 1 and Fig 2. Note the steps in these curves as each of the three motors is put on the line. The var surging is not due to an undamped meter. These were two emergency shut-downs when 60,000 and 41,000 kw were dropped by opening a circuit breaker. Two other shut-downs dropped 40,000 kw and 27,000 kw in about one minute each.

An analysis of tie line load (Fig 3) and the NACA charts shows that only a small percentage of the load pickup appears on the tie. However, 50%

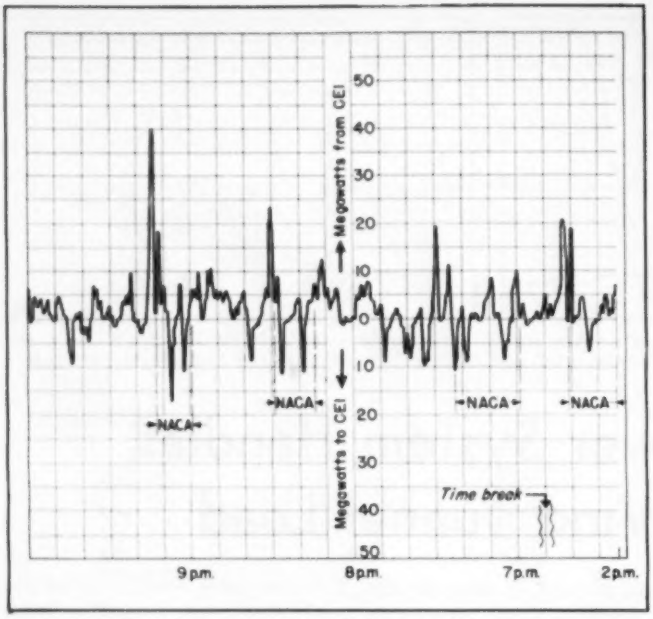


FIG 3—TIE LINE LOAD chart taken during initial test of 87,000-hp wind tunnel reflects only a small percentage of the load pickup. But 50% or more of the load drop off shows up on the tie. The faster the load reduction, the more swing

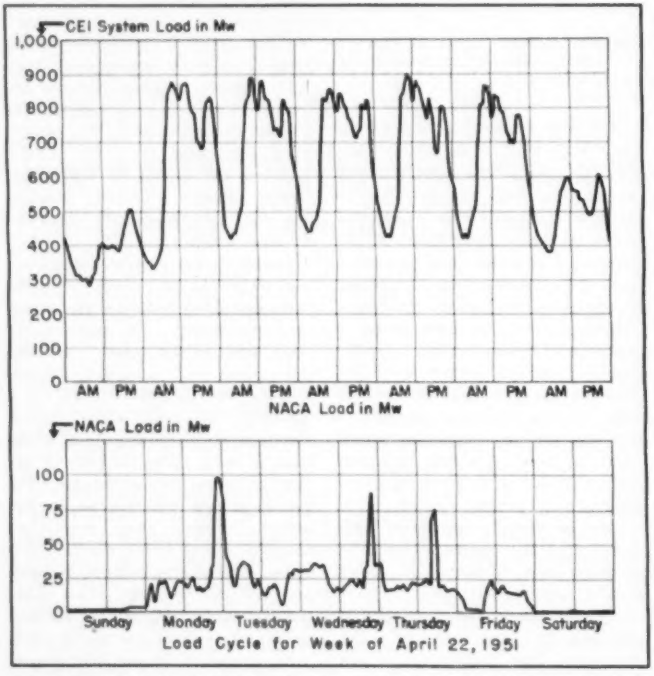


FIG 4—WEEKLY LOAD CURVES for the CEI system and the NACA wind tunnel show little tunnel activity on weekends. Monday evening load shows principle used in loading tunnels rapidly. Tunnel picked up 60 Mw in about ½ hr. Rest of system load dropped off 50 Mw

or more of the load drop-off showed on the tie—the faster the load reduction, the more swing appearing on the tie. The load control then in use responded at a rate of about 15,000 kw per minute. This was 3% of the capability of the generators being controlled. Conclusions of this test were that if the NACA load pickup and drop-off were at a rate of 5 Mw per minute there would be neither disturbance on the tie line nor objectionable boiler operation.

Extend Tie Line Load Control . . . In anticipation of the desire of NACA to get on the line in still less time, our tie line load control is being extended to all generators. CEI is also analyzing the tie line load control from the viewpoint of a servo-mechanism so that a much faster response can be had when needed and still result in stable operation.

Wind tunnel loads are off-peak loads. This does not mean that they are only on the line from midnight to 5 am during the minimum load period. Practically, off-peak means five minutes after you have passed your peak for the day. A typical seven days system load and wind tunnel operation of last April is shown in Fig 4.

It shows very little wind tunnel activity on weekends, a short activity at the supper time load period on Thursday. The Monday evening load illustrates the principle which is used when it is desired to load up the tunnels as rapidly and as early as possible. On this evening the tunnel picked up 60,000 kw in about ½ hour. The rest of the system load must have dropped off 50,000 kw in the same half hour because our gross load increased only 10 Mw. It is quite essential to dove-tail the air lab load build up with the system normal load drop off in the late evening.

New Idea . . . A novel idea for starting up a wind tunnel, which we have not yet explored, is to set boiler control to pickup load at some predetermined rapid but feasible rate; then the tie line load control could feed its signal to the wind tunnel. In this way, full advantage could be taken of the system's normal load reduction around 11 pm to midnight to pick up the tunnel load at the maximum rate possible.

For example, if load drops at a rate of 2,500 kw per min and if boilers can pick up 5,000 kw per

min, the combined rate available to the air lab is 7,500 kw per min. Thus a 200,000-kw load could be picked up in less than a half hour without severe swings on tie line or boilers.

Maintenance Scheduling . . . The scheduling of routine maintenance during off-peak hours becomes a major problem when such large off-peak loads are not made firm commitments until possibly late afternoon.

It was mentioned earlier that the NACA contributed to CEI system peak recently in exactly the same proportion as their monthly kwhr bore to our system kwhr. Fig 5 is a chart of our system peak of 800Mw in 1949, and Fig 6 is the NACA load of 20 Mw at the same time. Both loads are bigger today. The relatively large daytime load at the Cleveland laboratory of the NACA is due to the fact that this is a propulsion science laboratory. Many power-consuming tests are made at all hours over and above the actual operation of the large wind tunnels.

Ordinarily induction motor effects are neglected when analyzing system fault and stability conditions except for a one cycle consideration of momentary currents. However, CEI decided that a formal analysis should be made to ascertain if this assumption was valid in this case. In particular it was felt that the combination of these large induction motors with capacitors across their terminals which will bring the pf near unity might contribute appreciably to system faults. A preliminary study of this problem is in progress now.

Unnecessary Shut Down Serious . . . The consequences of unnecessarily shutting down a wind tunnel are most serious to the air lab people if they are operating above sonic speed. In this case it is necessary to come back through the sonic barrier in a definite manner, or the test sample may be destroyed by the shock wave.

The consequences to the power system, however, can be very serious at any time if such a large load is suddenly dumped. No matter how effective the tie line load control is, an appreciable amount of the dumped load will appear on the tie line as export power. While your own ties may possibly be able to handle this swing, it is possible that somewhere in the interconnection this power may add to that on an already heavily loaded tie and cause a trip out or other instability problem. It is thus desirable not to dump such a load except in emergency, and one's power system should be so arranged that secondary effects of system disturbances do not cause serious consequences.

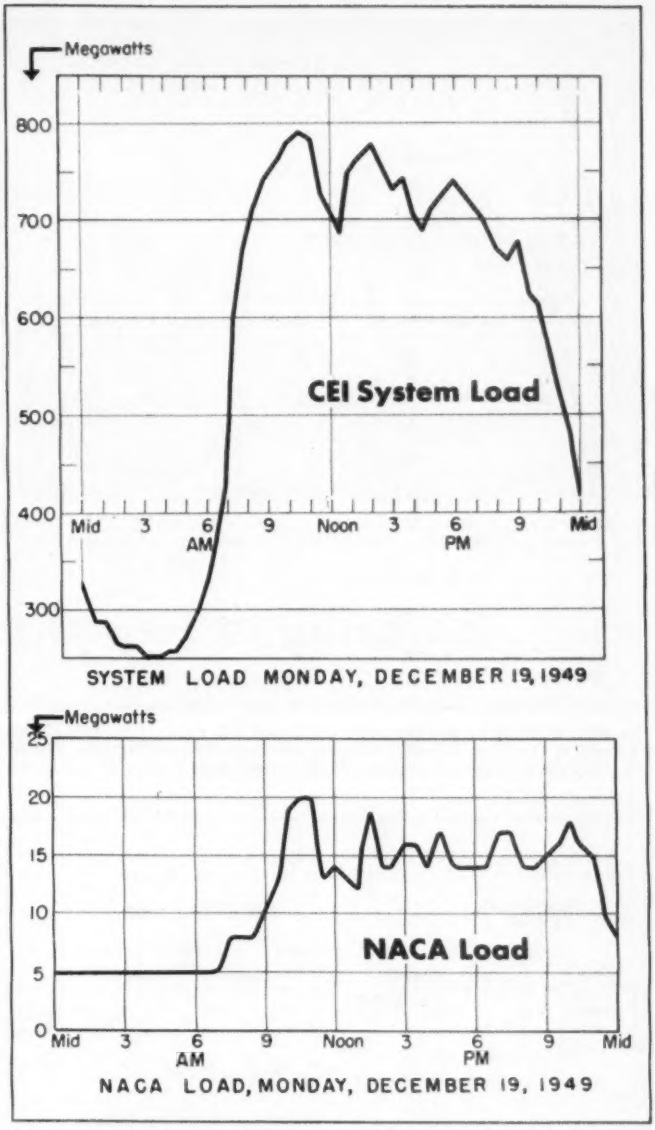


FIG 5-6—PEAK LOAD CHART shows CEI system peak of 800 Mw and NACA load of 20 Mw at same time. Relatively large daytime air lab load is from non wind tunnel operations

Troubles at the wind tunnel are divided into four categories:

1. Failures which sound alarms only.

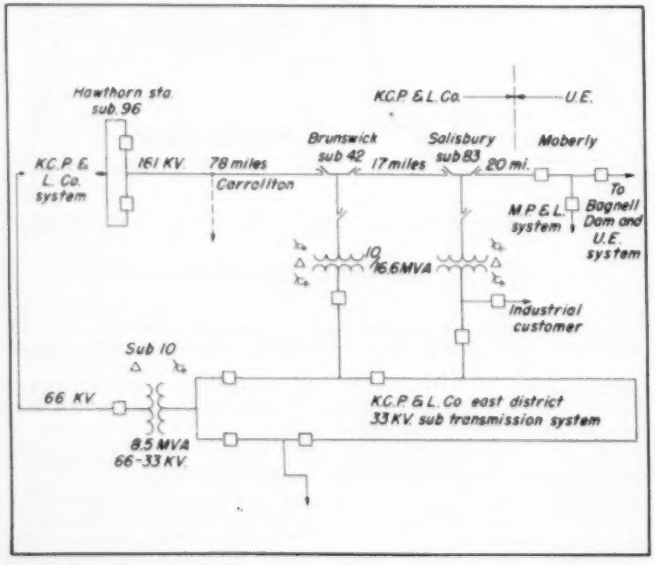
2. Failures which cause equipment to shut down in a normal sequence at about the same 7 to 8 Mw/min as to pickup.

3. Motor failures, fast shut down but not instantaneous.

4. Full emergency, push-button drops entire tunnel load in one bite.

It is quite essential that the control scheme be foolproof so that minor troubles do not degenerate into sudden dumping of load.

206-MILE 161-KV LINE linking Kansas City and St Louis, built at cost of $4.5 million makes it possible to wheel power between Missouri-Iowa and Georgia-Alabama. Two major loads tap the interconnection which will also carry 75,000 kw interchange between the two utilities



LINE TIES Sub 96 to Union Electric Co system at Moberly with two major loads tapping at Sub 42 and Sub 83. Sub 10 feeds 33-kv radial system, tied to 161-kv line through Sub 42 and Sub 83. All relaying was designed on this basis

TIE LINE is of H-frame construction. Line conductors are 556 MCM, ACSR, with $\frac{3}{8}$-in.

161-Kv Line

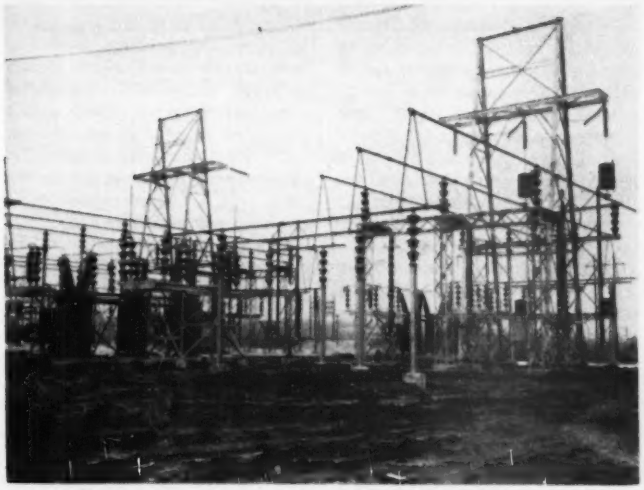
J. R. MILLER, Kansas City Power & Light Co, Kansas City, Mo.

The newly energized (EW, July 21, p 9) 161-kv interconnection between Kansas City Power & Light Co and Union Electric Co of Missouri has been tapped by two major loads. This involved some unusual relaying problems.

Moberly Station serves as the east interconnection terminal and also provides a 161-kv source of supply for the Missouri Power & Light Co. Moberly station is connected into the Union Electric system with a new 161-kv line to Bagnell Dam.

About 78 miles east of Sub 96 the interconnection is tapped by 10/16.6 mva, 161/39-kv step down Substation 42, near Brunswick, Mo., designed to pick up part of the load presently served by a 33-kv loop from Sub 10 with one 66-kv source. About 17 miles east of Sub 42 the interconnection is tapped by another 10/16.6, 161–39-kv step down substation that picks up more of the growing load in the area in addition to a large industrial customer. For economic reasons, 161-kv sectionalizing breakers will not be provided at either Sub 42 or 83.

galvanized steel shield wires mounted at the tips of each of the H-frame wooden poles



KANSAS CITY TERMINAL of the line is in Substation 96 at the Hawthorne Station. Conventional distance carrier current relaying will be provided at Sub 96 and at the Moberly terminal

Relaying Problems Complicated . . .

. . . by major loads tapping important new interconnection. Solution gives preference to tie line at same time protecting load substations

For the immediate future the Sub 83 and Sub 42 sources will not be looped into the 33-kv system which is fed from Sub 10. The system instead will be divided into four radial sections with two sections fed from Sub 10 and one each from Sub 42 and Sub 83. However, as the 33-kv system load grows and service continuity becomes more important, loop operation will be attempted. All necessary relay equipment will be provided now for loop operation, and relaying was designed on this basis.

Special Relaying Problems . . . Since it was imperative to provide high-speed protection, distance carrier current relaying was chosen for the 161-kv line section. Since by mutual agreement of the interconnecting companies the interconnection will be considered of preferred importance and the load taps will be of secondary importance, the decision to tap loads at both Sub 42 and 83 created special protection problems as follows:

1. For economic and phasing reasons, the Sub 42 and Sub 83 transformers were purchased with grounded wye 161-kv and 39-kv connections with delta tertiary. With this connection, zero sequence current will be furnished from Sub 96 and Moberly for 33-kv circuit ground faults. This is, of course, objectionable since the carrier ground relaying at the interconnection terminals could clear the high line for the frequent ground faults on the 33-kv rural subtransmission system.

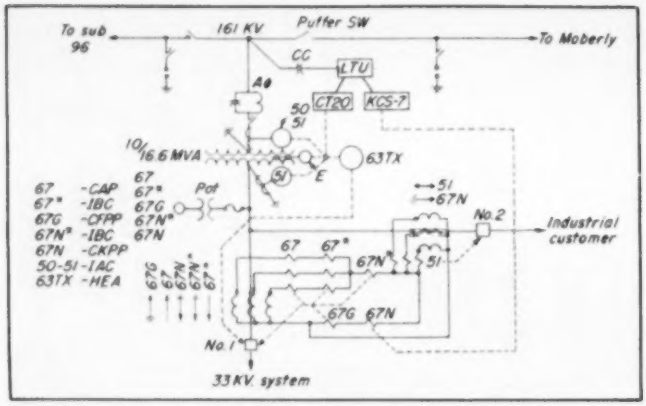
2. As 161-kv breakers were not purchased for Sub 42 or Sub 83, high-speed transformer protection could not be provided by conventional methods.

3. With the 33-kv system arranged for loop operation, faults on the 161-kv line could be fed from 33-kv, thereby by-passing the high-speed line protection provided at Sub 96 and at Moberly. Also, the 33-kv system could be subjected to outages from the Sub 10 relays because of faults on the 161-kv line.

Terminal Relaying . . . Conventional distance carrier current relaying is provided at Sub 96 and at the Moberly terminal. At each terminal the carrier transmitter-receiver is rated 25 w, 50–150 kc, 125 v dc, and set to operate at 141 kc. Operating in conjunction with the carrier set at each terminal are the following primary relays:

1—Carrier current receiver relay
1—Directional carrier current ground relay
3—Directional distance relays
1—Auxiliary timing relay
1—Distance relay
1—Directional blocking ground relay
1—Instantaneous overcurrent relay
1—One shot reclosing relay

These devices will provide high-speed protection for the transmission line by the directional comparison method. This scheme compares contact positions of directional relays at each line terminal. When an external fault occurs, a continuous carrier signal is transmitted that blocks tripping at both terminals. When the fault is internal, no continuous carrier signal is transmitted; and tripping is permitted at both terminals.



SPECIAL RELAYING equipment was chosen to overcome problems introduced by tapping tie line with major loads. Equipment was designed for loop operation with the 33-kv system

Instantaneous tripping is provided by this means through the Zone 1 and Zone 2 elements of the distance relays for phase faults and through the carrier ground relay for ground faults. Time delay backup protection is provided by the Zone 3 element of the distance relays for phase faults and by the directional ground relay for ground faults.

With carrier out of service only Zone 1 is instantaneous, Zones 2 and 3 operate on time delay, and the carrier ground relay is inoperative. For close-in ground faults, within 80% of the line to Sub 42, the instantaneous overcurrent relay provides instantaneous tripping independent of carrier. This relay provides inexpensive high-speed backup ground protection for a section of the line if carrier is out of service or if it should fail to operate.

At Sub 96, Zone 1 is set to reach to 90% of the line to Moberly, Zone 2 to 30% of the Moberly to Bagnell section, and Zone 3 is connected in reverse direction to turn on carrier for faults external to the section. At Moberly, Zone 1 is set to reach to 90% of the line to Sub 96, Zone 2 to about 130% to Sub 96 in order to insure coverage of the Sub 96 bus, and Zone 3 is connected in reverse direction to back up the Moberly-Bagnell section and to turn on carrier to block tripping of the Kansas City-Moberly section.

The distance blocking relay at Sub 96 blocks tripping through the Zone 1 or Zone 2 elements as a result of power swings or loss of synchronism. However, the Zone 3 unit operates after its time delay should a fault occur after out-of-step blocking is initiated. At the Moberly terminal the out-of-step blocking relay is in service because, for loss of synchronism conditions, it is desirable to trip at Moberly and remain closed at Sub 96 so that Sub 83 and Sub 42 are fed from Kansas City, and Missouri Power and Light is fed from Union Electric.

One-shot instantaneous reclosing is provided at Sub 96 and at Moberly if tripping is by Zone 1, Zone 2, or by carrier ground relay only if carrier is in service.

Load Taps . . . Relaying at the load taps, Sub 42 and Sub 83, will be quite similar. Relaying equipment that overcomes the special problems at these points is shown above.

Breaker No. 2 serves a load with no possible generation source. It is relayed by non-directional over-current phase relays set to coordinate with the customer's main primary fuses. No advantage could be gained by use of a ground relay since ground fault current will be practically of the same magnitude as phase fault current.

Breaker No. 1 will serve the 33-kv loop which has possible generation source. It will be relayed by directional over-current phase and ground relays for 33-kv circuit faults. Also it is relayed by a three-phase directional power phase relay, and a directional ground relay. These operate instantaneously with current flow from 33 to 161 kv to clear interconnection line faults from the 33-kv source coordinated with the Sub 10 relays.

Tie Line Preference . . . As mentioned above, the grounded wye power transformer permits passage of zero sequence currents so that ground faults on the 33 kv may appear as internal faults to the instantaneous carrier ground relays at Sub 96 and at Moberly. To eliminate this hazard to the high line service continuity, an instantaneous directional carrier ground relay, is installed in the current residual circuit common to both 33-kv circuits. Its function is to operate a local carrier unit to transmit a continuous 151-kc signal to clock tripping at Sub 96 and at Moberly until the slower overcurrent relays on Breaker No. 1 or 2 clear the fault. This blocking is only necessary for ground faults on the 33-kv system.

Instantaneous phase relaying at Sub 96 and at Moberly, provided by Zone 1 and Zone 2 elements of distance relays, does not operate for 33-kv faults, because the setting of the impedance elements does not permit them to reach through the impedance of the power transformer. For phase fault protection at Sub 83 and for back up of the 33-kv breakers, instantaneous and time delay overcurrent relays are connected to current transformers in the power transformer 161-kv bushings. These relays will trip Breaker No. 1 directly and the Sub 96 and Moberly terminals by the transfer trip scheme described below.

For 33-kv ground backup at Sub 83, an overcurrent relay is connected in the power transformer 33-kv neutral. Again No. 1 Breaker at Sub 83 and the Sub 96 and Moberly terminal trip the same as for phase faults. Of course, 33-kv bus ground faults relay instantaneously at Sub 96 and at Moberly with carrier in service.

Reclosure equipment is provided for Breaker No. 1 at Sub 83 to operate on faults in either direction. In order to avoid by-passing the Sub 96 and Moberly reclosures, the Sub 83 first reclosure is delayed sufficiently to permit completion of reclosing functions through lock out at the line terminals. For sustained 161-kv faults, Breaker No. 1 at Sub 83 recloses on the fault twice after the line terminal breakers have locked out. This does not result in further equipment damage because fault currents as furnished from the 33-kv system are always of small amplitude magnitude.

In order to provide high-speed protection for the power transformer at

Sub 83, a transfer trip scheme is employed using frequency shift carrier equipment in conjunction with a Type E transformer pressure relay. With this scheme, a carrier transmitter is installed at Sub 83, and carrier receiver units are installed at both the Sub 96 and Moberly terminals. Under normal conditions, a guard frequency signal of 88 kc is continuously transmitted and received, thus providing a constant monitoring system.

Identical transmitter and receiver units, operating at a different frequency, are installed for Sub 42 transformer protection. When actuated by the transformer pressure relay, the transmitter shifts the signal at the line terminals. Auxiliary relays are energized to trip and to block closing. At Sub 83 the transformer pressure relay trips Breaker No. 1 directly, thus isolating the faulted transformer.

Communication . . . Carrier communication is provided from Kansas City to Moberly over a separate phase using two-frequency, duplex-type equipment at each terminal. The 25-w transmitter-receiver units operate at 105 kc to provide communication in both directions simultaneously so that the speakers can break in or interrupt each other at any time. Communication stations are at the Kansas City load dispatcher's office, Kansas City Northeast Station, and at Moberly. At the Moberly terminal a repeater unit works into the Union Electric microwave communication system carrying voice communication to Bagnell and to the St. Louis dispatcher's office.

Local station-to-station carrier "push-to-talk" voice communication is available for testing over the relaying channel using the relaying transmitter-receiver units. Fault relaying takes preference over communication.

No carrier voice communication is available between the dispatchers and Sub 83 and Sub 42. For operating these unattended stations, mobile radio communication is used. A radio repeater station is being installed to strengthen the signal to and from this area.

Telemetering . . . Interchange megawatts, megavars, and kilovolts are metered and recorded at Moberly and telemetered to Kansas City over a separate phase.

Megawatts are recorded at Moberly. The frequency modulated system is used with 20–25-cycle variation in conjunction with a crystal controlled transmitter operating at a center frequency of 198.55 kc to send megawatt intelligence to Kansas City. At Kansas City, a receiver and converters operate the recorders at the load dispatcher's office and at Northeast Station. This scheme will provide a continuous megawatt measurement.

Recorder units record megavars and kilovolts at Moberly. Both quantities are telemetered to Kansas City by the frequency shift impulse system with crystal controlled transmitters at Moberly and crystal controlled receivers with recorders at the load dispatcher's office and at Northeast Station. Kilovolt frequency shift impulses are transmitted at 196.65 kc while megavar frequency shift impulses are transmitted at 197.60 kc.

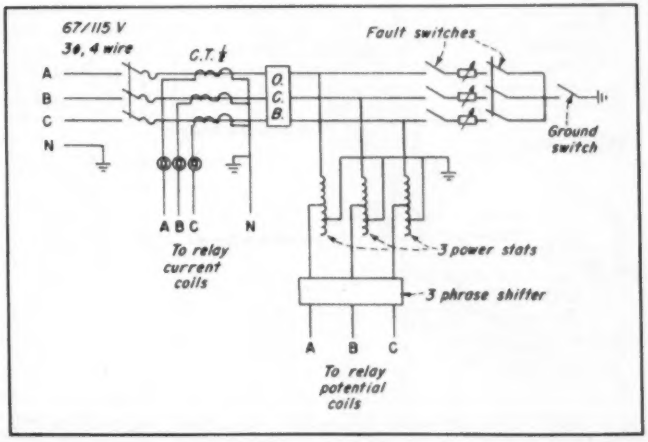
System Operation . . . No supervisory equipment is provided for remote operation of the interconnection at this time although Sub 42 and Sub 83 are unattended. For trouble at Sub 42 and Sub 83, operators are dispatched from the East District offices. For trouble analysis at Sub 42 and Sub 83, relay targets are observed for breaker operation, and local annunciator lights signal conservator diaphragm, oil level, temperature, fans, and pressure relays for power transformer trouble.

The Sub 96 terminal is operated from the main control room at Hawthorn Station. Annunciator alarms are provided from breaker trip, breaker low air pressure, line relay trip, and transfer trip trouble. The transfer trip alarm is actuated from reception failure of either the Sub 83 or Sub 42 guard frequencies. Lamps at the Sub 96 relay panels, and at the load dispatcher's office indicate whether the trouble is on the Sub 83 or Sub 42 equipment. On a transfer trip operation, lamps at the relay panel and the load dispatcher's office indicate which transformer is in trouble.

Gas pressure type arc extinguishing line switches are installed on the east side of Sub 83 and on the west side of Sub 42. This type switch breaks line charging current and permits switching operations while the line is energized from one terminal.

Synchronizing is normally handled at Kansas City or at Bagnell Dam. Synchronizing facilities are provided at Moberly for unusual conditions. When the Moberly-Bagnell line is out of service, synchronizing between Kansas City and Missouri Power & Light may take place at Moberly.

Relay Testing . . . All relays were inspected and tested at the relay shop before installation. Before placing in service, and periodically thereafter, operational tests were performed on the relaying unit to simulate phase-to-ground, two-phase-to-ground, phase-to-phase, and three-phase faults. Experience with this type of operational testing has been quite favorable since several errors have been detected in relay operation which would have been otherwise missed by the conventional push-contact checking method.



OPERATIONAL TESTING results have been favorable with the special testing method followed

Kilovar Supply Should Be Planned . . .

. . . so that the amount of kilovar capacity available equals the peak kilovar load plus a reserve for contingencies. This new concept of system planning is discussed here along with problems associated with planning kilovar capacity

C. H. HOFFMAN, Engineer, Electric Distribution Department, Public Service Electric & Gas Co, Newark, N. J.

Most fundamental consideration in the solution of any system planning problem is the standard to which the system is designed. Planning is an inconsistent process unless it is based on a set of rules.* Such rules are not expected to be invariable. They are a statement of policy that it is believed will assure adequate, economical, and coordinated system design.

On the system of the Public Service Electric & Gas Co the standard for kilovar capacity which has been followed for the past three years is this:

"The total of installed kilovar capacity on either the northern or the southern portion of the system shall not be less than the estimated peak kilovar load of that portion of the system, increased by a reserve equal to the kilovar capacity of any two large generators and adjusted for reasonable interconnection and inter-area deliveries."

For this purpose the division between northern and southern portions of system (Fig 1) is midway on the 29-mile, 132-kv line from Trenton to Metuchen. Both experience and network analyzer studies have shown that kilovar capacity and loads may be compared arithmetically in the north and in the south, as a first approximation. However, the tie line is better treated as an interconnection of limited kilovar capability, the amount of its capability depending upon the kilowatt flow at the time of the high kilovar demand.

Peak kilovar load, for this purpose, is ordinarily experienced on a day when the kilowatt load is at or near peak. The rule would not be reasonable if this were not true. From a voltage standpoint, this load level of high kilowatts and high kilovars is the most difficult condition to be met.

Analogous Methods . . . Provision of kilovar capacity enough to carry the load, plus a reserve for contingencies, is analogous to conventional practice for kilowatt supply. The need for kilovar reserve is just as real as the need for kilowatt capacity in excess of forecast load. Kilovar reserve should be higher than kilowatt reserve because it is more difficult to transmit

* See: Nine Guides To System Planning, R. G. Hooke, Electrical World, Aug. 27, 1949, p 87-90

Adapted from a paper before the EEI Electrical Equipment and Transmission and Distribution Committee

FIG 1—HIGH VOLTAGE SUPPLY and interconnections of the Public Service Electric & Gas Co. For planning purposes, system is divided into Northern and Southern areas as shown

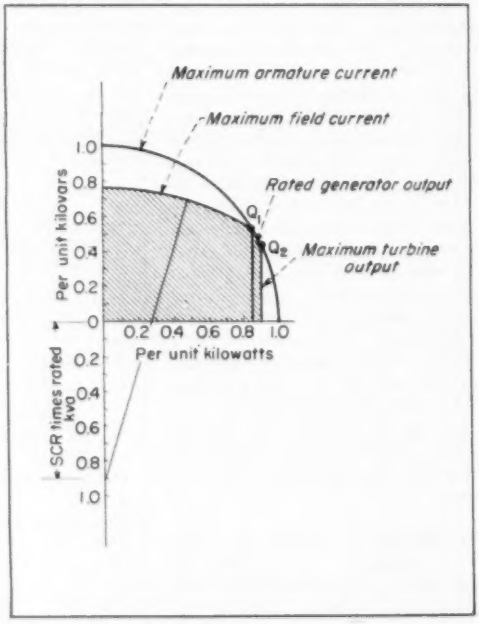


FIG 2—GENERATOR OUTPUT CHART of type used to determine kilovar capacity of system generators, corresponding to maximum kilowatt capacity of the particular machine

Eight Fundamental Points In Planning Kilovar Supply

1. In planning kilovar supply, systems should be subdivided into areas of limited size.

2. Kilovar capacity in each area should be equal to the load plus a reserve for contingencies. This reserve on the Public Service system equals the kilovar capacity of two large sources in the area.

3. Kilovar loads can be predicted from kilowatt and power factor forecasts, if corrected for charging current and capacitor installations.

4. Comparison of kilovar load and net capacity (after reserve allowance) will indicate required capacity additions. Transmission sources should be included.

5. Unswitched capacitors on distribution are the first choice for kilovar capacity, up to the limit set by generator power factor at minimum load. Switched distribution capacitors are considered promising.

6. Switched capacitors can be used in large substations and are preferable to synchronous condensers today.

7. Kilovar capacity required for area reasons should be located to secure the maximum local benefits, usually close as practicable to the load.

8. Consideration should be given to where kilovar reserve should be kept during normal conditions, when not in use. Interconnections offer possibilities.

kilovar reserves from one area to another (six times on the Public Service 132-kv system) and because of the larger errors in forecasting kilovar load.

Provision of a reserve amounting to two large machines is based on the assumption of a forced outage overlapping a maintenance outage. While it is not normal practice to schedule a maintenance outage of a large machine during the winter peak period, it is usual to have some synchronous capacity unavailable at that time. There are occasions when this adds up to 60 to 80 Mvar, equivalent to the capability of one of the larger generators on the system. The intention is to be able to continue to provide service, although at emergency voltage levels, in the event of the forced outage of an additional single large source.

During the summer months the overlapping outage of two large machines, or the equivalent, is even more probable. As summer kilovar loads on the Public Service system are within 5% of the following winter peak, it is frequently true that summer conditions govern the kilovar program.

A Standard That Works . . . The real test of a standard, however, is not its theoretical appeal but how it works. In general, whenever we have been unable to install enough kilovar capacity to meet the standard, we have had trouble with low system voltage. Conversely, whenever capacity was up to the standard, system voltage conditions have been satisfactory.

In December 1950, for example, kilovar reserve in the north was down to 30 Mvar instead of the 120 Mvar normally provided. On the peak kilovar day, outages for maintenance and other purposes amounted to 65 Mvar. This meant that 35 Mvar had to be supplied by reducing kilowatt output of generation and by reducing voltage levels for additional flow from interconnections and the south. Some low-voltage trouble was experienced. Forced outage of an additional large machine, as covered by the standards, did not occur on this day, but less than three weeks later a forced outage of several smaller machines that were equivalent to a large machine was experienced. Fortunately, in the meanwhile the amount of capacity unavailable for maintenance was greatly reduced, and the loads were slightly lower so that trouble was not encountered. If the design reserve had been available, the maintenance and the forced outages could have overlapped without causing trouble.

Calculation of Requirements . . . How the standards are applied to the calculation of kilovar requirements is best explained by example. Take the northern part of the system as example. The capability of present and future generators is first totaled by stations, as in Table I for Kearny Station. The capability used is the maximum kilowatt capacity and the corresponding kilovar capacity of each machine. These are determined from generator output charts obtained by tests or by construction.* Fig 2 is a typical chart obtained by such construction.

Table II summarizes the generator capacity located in the northern stations. To determine the firm generator capacity, the two largest machines are assumed out of service, as discussed

* See: Electrical Transmission and Distribution Reference Book, Westinghouse, 1950, p 152

Table I — Generator Capability At Kearny Station

Unit	Megawatts	Megavars	
1	40.0	19.0	
2	52.0	20.8	
3	40.0	19.0	
4	52.0	20.8	
5	40.0	19.0	
6	90.0	40.0	
1M	20.0	15.0	
Present total	**334.0**	**153.6**	
7*	137.5	85.0	(add in 1952)
8*	137.5	85.0	(add in 1953)

* Excluding auxiliary generator

Table II — Calculation of Firm Generator Capacity In Northern Area

	1951		1952		1953		1954	
	Mw	Mvar	Mw	Mvar	Mw	Mvar	Mw	Mvar
Marion	210	111	210	111	210	111	210	111
Kearny								
Present	334	154	334	154	334	154	334	154
Future	....	....	138	85	275	170	275	170
Essex	324	165	324	165	324	165	324	165
Sewaren	431	247	431	247	431	247	431	247
Northern total	**1299**	**677**	**1437**	**762**	**1574**	**847**	**1574**	**847**
Two largest units	239	139	256	159	275	170	275	170
Northern firm generator capacity	**1060**	**538**	**1181**	**603**	**1299**	**677**	**1299**	**677**

Table III — Kilovars Available to Northern Area From Transmission Sources

		1951	1952	1953	1954
Northern load at time of kilovar peak	Mw	1187	1265	1360	1440
Generator capacity with 2 machines out	Mw	1060	1181	1299	1299
To be imported	Mw	127	84	61	141
From interconnections*	Mw	81	66	64	59
From south*	Mw	46	18	−3	82
Corresponding megavar capability					
From interconnections*		25	25	25	25
Add for TCUL at Roseland		...	20	20	20
From south**		30	40	10	35

*Based upon network analyzer studies
**Limited by megavar capability of south or by voltage drop in Trenton-Metuchen circuits

Table IV — Comparison of Northern Kilovar Capacity and Load

	1951	1952	1953	1954
Firm generator capacity (Mvar)	538	603	677	677
Switched capacitors				
Present	107	107	107	107
Future	...	17	25	25
Synchronous condensers	155	155	155	155
From interconnections	25	45	45	45
From south	30	40	10	35
Total capacity (Mvar)	**855**	**967**	**1019**	**1044**
Winter peak load (Mvar)	904	920	1020	1105
Surplus (Mvar)	...	47	...	...
Deficit	49	...	1	61

Table V — Approximate Present Costs of Kilovar Capacity and Amounts In Service

Location	Type	Dollars/Kvar	Now In Service
Distribution 4-kv circuits	Unswitched capacitors	5	335 Mvar
Distribution 4-kv circuits	Switched capacitors	7	2
Substation 4-kv buses	Switched capacitors	10	114
Substation 4-kv buses	Synchronous condensers	20	98
Switching station 26-kv buses	Switched capacitors	14	0
Switching station 11-kv buses	Synchronous condensers	20	85
Generating stations	Generators	3	830

in the preceding section. Observe that the capacity represented by the two largest units increases in the future as a result of the installation of larger generators.

We also make a tabulation of the kilovar capacity available in synchronous condensers and switched capacitor banks. All of these facilities are considered as sources of kilovars. On the other hand the capacitors located in the outside plant are considered part of the load because their effect is to reduce the net kilovars seen by the inside-plant sources.

Other Kilovar Capacity . . . In addition to the kilovar capacity available in generators, synchronous condensers, and capacitor banks in each part of the system, some kilovar capacity can be made available by transmission. This amount is limited because of the excessive voltage drops associated with large kilovar flow. Table III gives the kilovar capacity available to the northern area from interconnections and from the south. The kilowatt flows shown for this emergency condition have been estimated from network analyzer studies which include the effect of the interconnections in the south. The concurrent kilovar flows are usually limited by voltage drops.

In the case of the flow available from the southern area in 1951 through 1953, the limitation is expected to be the lack of capacity at the sending end. As indicated in the tabulation, the amount available in the north from interconnections will be increased by the installation of tap changers on the 220-kv transformer banks at Roseland.

Kilovar capacity and load for the north are compared in Table IV. Only winter conditions are shown. In actual practice summer conditions are also calculated and frequently are more severe than winter. The small load growth in the north between 1951 and 1952 results from the fact that an 11-mile, 132-kv cable is being installed this year. This will add some 45 Mvar of charging current, which appears as a negative load growth of that amount. The 1952 capacitor program in the north is being carried out entirely for local subtransmission and substation relief. No trouble was experienced in the winter of 1951, even though there was a shortage of kilovar capacity in the north, because of the unusually high availability of generators during the period of high loads. A kilovar program to avoid the deficit in 1954 is now being planned.

It should be emphasized that this method of determining kilovar requirements is not exact down to the last 1,000 kvar or even to the last 10,000 kvar. As has been indicated in the example, kilovar capacities of some sources are not rigidly fixed. Increased generator kilovar output can be obtained by sacrificing kilowatt output. The kilovar capabilities of transmission sources are determined to a large extent by what emergency voltage level is acceptable. The important thing, however, is to have a method and to follow this method consistently, long enough to determine its value. Modifications and improvements can then be made.

Choice of Supply Types . . . Costs have a very important bearing in most planning problems. In this case, however, the introduction of cost data results in some simplification. Table V gives approximate estimated costs per kilovar for various types of kilovar capacity. They are arranged in the order of decreasing system benefit. Only methods now used or planned by Public Service are included in the tabulation. Except for kilovar capacity in substation synchronous condensers and in generators, the costs generally are increasing as the benefits are decreasing. Because of this the economic solution is to saturate the system with each type in turn, working down the list until the necessary amount is provided.

Unswitched Capacitors . . . The largest block of kilovar capacity outside of the generators is in unswitched distribution capacitors. The 335 Mvar are 22.6% of the 1951 peak megawatts of 1493. Included in the total are some 40 Mvar connected to tie

feeders, which to some extent are out of service during light-load periods. The minimum load reached during the 1951 Christmas holiday period was 468 Mw and 166 Mvar. By having most of the switched capacitors out of service and by underexciting the synchronous condensers, the kilovar load on generators and interconnections was kept up to 244 Mvar, a power factor of 89%. We expect to raise this gradually in the future.

Pole-mounted, automatically switched capacitors in the distribution plant consist of seven 300-kvar installations. The first one of these went into service about a year ago. Experience to date indicates that results are satisfactory when the device is carefully applied. Surveys indicate that 20 Mvar of these devices could be added throughout the system to solve existing regulation problems. The long-range trend will probably be for this type of kilovar capacity to assume the importance its relative cost and usefulness indicate.

Installations of capacitors in 4-kv substations have amounted to 114 Mvar in the last five years, with 65 Mvar more planned for 1952. This capacity has been installed mostly for system reasons, but the substations selected have been those where the maximum secondary benefits could be obtained. Installations range in size from 2 to 8 Mvar. Nearly half are 8 Mvar. This is ordinarily the upper limit that can be installed economically at a substation.

Because the cost of the circuit breaker and controls is largely independent of the kilovar capacity, the smaller installations are heavily penalized, 4 Mvar being the lower limit except for a few special cases. The smaller substations cannot absorb even this much kilovar capacity on the 4-kv bus without overloading the transformer or encountering excessive voltage variations when the capacitors are switched. Thus only the larger substations are likely ones for capacitor installations, and the maximum amount that can be utilized at each of these is limited by various electrical and physical considerations. Since the trend of new substation development is toward a larger number of smaller stations, the number of likely substations for capacitor installations is not increasing much.

The synchronous condensers in the substations and switching stations date back to the years when the substation capacitor banks were not available or were more costly. No synchronous condenser installations are being planned for the short-range future. Synchronous condensers have several other disadvantages in addition to their higher cost. Unlike capacitor banks, an outage for failure or maintenance can be of long duration, thereby raising the possibility of overlapping outage. Another disadvantage of the rotating equipment is its higher losses, from 5 to 10 times as much as static capacitors. The importance of this disadvantage depends upon whether a high or a low evaluation is made of the demand element of the cost of losses.

Table V indicates an interest in switched capacitors in switching stations although none is now in service. An installation of two 10 Mvar banks is scheduled for service this year on the two 26-kv switching station buses at Burlington Generating Station. A large block of kilovar capacity, under immediate and positive control, is needed in this area to provide for forced and economy outages of generators at Burlington and to provide capacity to handle a large growth in load now expected in this part of the territory. Switched capacitors on distribution circuits do not offer the desired controllability or amount and the company-owned substations in the area are too small, so the 26-kv capacitors appear to be the best solution to the problem.

The generators are the other main source of kilovar capacity. The kilovar capacity in generators becomes increasingly attractive as the rated generator power factor approaches unity and as the cost of the alternative method of supply increases. The generators purchased by Public Service since World War II have been rated at 0.85 and 0.88 power factor.

Choice of Supply Location . . . Having determined the amount of kilovar capacity required and the types of supply to be adopted, the problem remaining is the location within the portion of the system concerned. The general principle is that the installations should be made where the maximum benefit is obtained. This may be determined by studying successively smaller portions of the system.

The separate treatment of northern and southern portions of the system is the first step in this process. The requirement for each of these portions is determined by the method already described. From this standpoint, the required kilovar capacity may be added anywhere within the north or south.

The next division is into the separate load areas, for example the group of substations supplied radially from West Orange or the substations supplied by the subtransmission network between Burlington and Trenton. If such a load area is shortly to require additional bulk-supply facilities, such as an additional 132-kv transformer, special attention should be given to the possibility of delaying the additional bulk facility by the kilovar program. One or two-year postponements of major facilities have very frequently been effected in this way.

Power Factor Objectives . . . Public Service designs in the general direction of having the light-load power factors of the major areas about the same and also the heavy-load power factors. This rule of thumb is modified in the direction of higher heavy-load power factors for the larger areas, such as Athenia, or those that are more remote from generation, such as West Orange. A suggested refinement is to prepare a megavar load and capacity tabulation for each of the load areas separately, using an appropriate assumption with regard to the reserve requirements.

The next step is to divide the total for the load area among the substations involved. Here again attention should be given to the possibility of delaying the installation of new facilities. Frequently additional subtransmission circuits or substation transformers can be delayed one or two years by kilovar additions.

For substation installations the smaller substations are almost automatically ruled out. Those remaining must be examined for power factor, voltage variation, and cost. The power factor at heavy load times should not be leading ordinarily because a reduction in the substation capacity may thereby result. In general it is undesirable to have the light-load power factor more than slightly leading because of high voltages during transmission outages. The voltage change when the capacitors are switched should be investigated to see if it is within the limits set for normal twice-a-day operation.

Electromode Corp

How Do YOU Look at Electric House Heating?

Here's what two utilities tell their customers who ask about electric house heating. These memos to employees are not edited, except for removal of identification of localities

Utility Viewpoint No 1

In July 1950, I sent you a memorandum on the subject of "Information About Electric Space Heating for Homes," which contained the information on which our answers to customers inquiring about this method of heating should be based. That memorandum pointed out that in answering inquiries about electric radiant panel heating, we should keep in mind that large and reputable manufacturers and distributors are spending a lot of money in promoting what may become a tremendous new electric load for us. It also pointed out that:

1. We did not have enough data to permit us to make any prediction as to what this method of heating would cost in a particular case.

2. Many factors influence the amount of fuel or electricity for heating a house—construction—thickness and kind of insulation—exposure—wind velocities—living habits, etc.

3. An interested customer should consult a distributor of these radiant panels and have him calculate the electric capacity required by his house and the amount of electricity which would be consumed per heating season, and that we would then be happy to figure out for him how much this would cost on the applicable electric rate.

4. We did not have sufficient information on the load characteristics to appraise the effect of this space heating load's seemingly low annual load factor and seasonal characteristics; that when we could obtain sufficient data we would then know whether or not it

Utility Viewpoint No 2

Recently, there has been much publicity about the use of electric panel radiant heaters to heat one's house, and the news stories have naturally caused a growing public interest in the subject. Perhaps some of your friends and acquaintances have asked you about them and the question may have come up as to why the company has not aggressively promoted electric house heating by way of increasing its business.

The answer, in brief, is that it is not an economical load for us to supply, and, no less important, it is not an economical way for a customer to heat his house. Why this is the case in the area we serve we shall try to explain as simply as we can.

Our rates 5 and 6, provide, in effect, for a charge of 3.3 cents per kilowatthour for electric house heating. Though this charge does not give us an adequate return for supplying this service, it is used in the table below to show the relative cost of heating with electricity, as compared with other fuels at current prices, in order to arrive at an estimate of possible customer acceptance of electric house heating.

Relative Cost of Fuel for Heating Average Five Room House in ....., Insulated and Equipped with Storm Windows

Method	Estimated Conversion Efficiency	Estimated Quantity	Cost per Unit	Annual Cost
Electric	100%	21,240 kwhr	$ .033	$700
Manufactured Gas	78	195 Mcf	.99	193
Anthracite Coal	50	6.2 tons	25.00	153
Oil	65	900 gals.	.186	113

Obviously, since the cost of initial installation for the various heating systems using the above fuels is about

Viewpoint No 1 (continued)

would be necessary for us to adjust our rates for this type of business.

5. We should keep in mind that electricity for space heating has many advantages over other methods namely:

Clean
- No dirt or gases
- No dust circulation
- Fewer cleaning bills
- Reduced painting expenses
- Reduced decorating cost

Healthy
- More uniform warmth
- Warm floors
- Natural humidity
- Less drafts
- Safe

Easy Operation
- Immediate heat
- Less heat lag
- Individual room regulation
- Simple automatic control

More Living Space
- No fuel storage
- No boilers or pumps
- No ducts or pipes
- No radiators or valves
- Plus space
- Cellar not necessary

Fewer Problems
- No fuel worries
- No tank or pipe repairs
- No pump repairs
- No boiler repairs
- No valve replacement
- No noise
- No maintenance

6. Customers interested in comparing cost of this method of heating with other methods, should remember that the over-all costs consist of:

a. The initial installation cost (and fixed charges thereon such as interest, depreciation, etc.)

b. Maintenance cost (repairs and upkeep on component parts of heating system.)

c. Operating expense (amount of fuel or electricity consumed per heating season.)

7. The customer should weigh the advantages and all the cost factors in reaching his decision as to whether to adopt this method of heating.

Since 1949 when the promotion of electric radiant panel heating commenced in .....and the surrounding territory, we have as of March 1, 1951 had reported to us 199 installations of these radiant panels for the total heating of living quarters. Of these 12 were in a tourist court, 32 in flats or apartments, and 155 in homes. During the 1949-50 heating season we obtained submeter records for a portion of that season on six installations, and during the 1950-51 heating season we have been submetering seven installations, six of which are different installations than were included in the earlier tests.

It must be understood that these tests, because of the many variables that enter into the problem, cannot be considered in any way conclusive. However, the results so far permit these statements to be made:

1. The electrical consumption per degree day per thousand cubic feet of heated space varied from .24 kwhr to .618 kwhr. Since there are 4587 degree days in a normal heating season in ..... this means that the normal heating season electrical consumption in the houses so far submetered varied from 1101 kwhr per thousand cubic feet of heated space to 2835 per thousand cubic feet of heated space.

2. Houses insulated in accordance with the recommendations of the manufacturers of these heating panels showed a smaller electrical consumption than those not insulated in accordance with these recommendations.

Our Residential Service personnel have interviewed 57 customers using this type of heating. In the surveys the customers were asked these questions: Are you

Viewpoint No 2 (continued)

the same, our charge results in an electric heating cost to the customer that is so much greater than the cost of using other fuels that a customer would be unwise to consider it.

Why, you may ask, is the cost of furnishing power for electric house heating considerably more than the cost of supplying normal household service? Basically this is due to the nature of the electric heating load and the size of the investment that we must make to handle it. The electric heating load, unlike normal electric use, is not spread more or less evenly over the year but is concentrated in one season and, in particular, upon the coldest days of that season. All or most of the electric house heating customers would be using power to operate their units at the same time on the coldest days, and we would have to have the power capacity in readiness to supply it.

But the average house heating use over the year is only a small fraction of the maximum heating use on the coldest day. This means that we should have to invest great sums of money for more generators, larger transformers, and heavier wire that would be used only a very small part of the time, we would have to pay just as much money in fixed costs (interest on money invested, maintenance, depreciation and taxes) on it as if it had normal use. It is as though you were to buy a new truck just to haul a few loads a year. In short, the company's investment per customer in new equipment to supply the electric heating load would be terrific, but his average use of this equipment would be extremely small, which explains why we must charge more per unit for electric heating than for normal use.

While the use of electricity as the only means of heating a house should be discouraged because it is economically unsound in our climate, there are many applications for electric space heating in the home that are entirely feasible. Many of our seasonal customers use electric heating for short periods over weekends in the spring and fall. Also, there are many uses for auxiliary heating in the home where an electric heater is the ideal solution. Electric heating of this sort is available under any of our household rates.

Viewpoint No 1 (continued)

satisfied with the heating performance? Are you satisfied with the cost of operation? Would you recommend this to others? The results of these surveys on a percentage basis are shown here as follows:

	Are you satisfied with the heating performance?		Are you satisfied with the cost of operation?		Would you recommend this to others?	
	Yes	No	Yes	No	Yes	No
Percentage	84%	16%	42%	58%	77%	23%

Of those who were dissatisfied with the heating performance 67% did not have fully insulated houses.

Of those who were dissatisfied with cost of operation 67% did not have fully insulated houses.

Of those who would not recommend it to others 77% did not have fully insulated houses.

This information is given to you as a further guide to assist you in handling customer inquiries concerning electric radiant panel heating of homes.

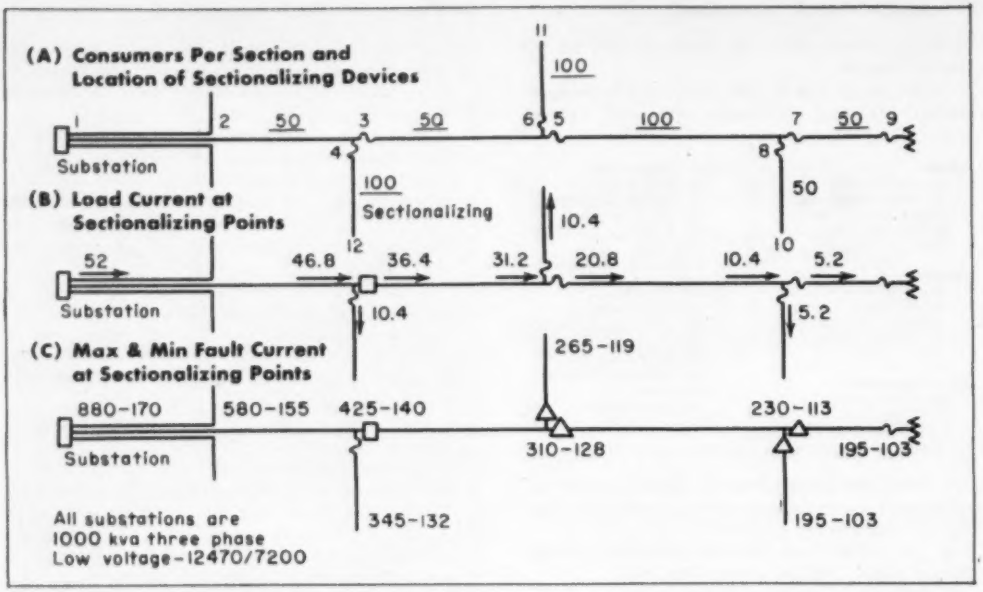


FIG 1—HYPOTHETICAL FEEDERS are assumed to illustrate possibilities of coordination between commonly-used line sectionalizing devices. Feeders are identical in length, conductor size, loading and tap location. An automatic feeder breaker is at each substation

Application and Coordination of Distribution System

Sectionalizing Devices

First of two articles explaining and clarifying the techniques of sectionalizer application and coordination which when properly executed can—

- **Improve service continuity**
- **Decrease damage to line and substation equipment**
- **Minimize costly service calls**

H. B. THACKER, Distribution Engineer, Electrical Utility Engineering Dept, Westinghouse Electric Corp, East Pittsburgh, Pa.

Coordinated automatic sectionalizing of the rural or suburban radial system from substation to consumer's service entrance has been furthered to a great extent over the past few years by the development of single and three-pole reclosers and automatic sectionalizers. These devices may be used, in conjunction with or in place of sectionalizing fuses, to secure the benefits of minimum customer outage resulting from temporary or permanent feeder faults.

Operation of a series of these devices in a primary feeder must be coordinated to assure that only the nearest device on the supply side of the fault opens to isolate the faulted portion of the system. By securing proper coordination of all devices the maximum amount of circuit is kept in service under abnormal conditions and service is maintained to the most customers.

Application

Customer's Premises . . . Methods and devices used to isolate faults on consumer's premises are well known. Plug fuses, cartridge fuses, and thermal-breakers of various types and ratings are commonly used. Coordination of these devices with the distribution transformer primary fuse link or secondary breaker prevents outages to other consumers supplied from the same transformer.

Secondary Service . . . Transformer secondary fuses and internal or external low voltage breakers may be used to clear faults on secondary mains or service drops from the remainder of the system. Secondary fuses are not extensively used since they generally do not permit loading the distribution transformer to its safe limit. Fuses of sufficient size to allow safe short-time overloading of the transformer are likely to not recognize and isolate a high impedance fault on the secondary service. In addition, when a primary fuse is used, a secondary fuse is not necessary for clearing a low impedance, high current fault on

the secondary service since the primary fuse ordinarily can recognize this condition. The CSP transformer secondary breaker, being actuated by both load current and oil temperature, is coordinated with the load capacity of the associated transformer. Its operating characteristic permits safe overloading while providing quick isolation of high current, secondary main, or service faults.

Distribution Transformers . . . A winding breakdown in a distribution transformer is cleared by means of an external primary fuse or an internal protective link. For CSP transformers the protective link is coordinated with the secondary breaker at the factory by the manufacturer. Conventional transformers require external primary fuses to protect the primary feeder against a transformer failure.

These primary fuses also furnish some protection to the transformer against overloads and against secondary main or service faults. Primary fuses are applied by the user and their application often is represented in terms of a fusing ratio. The fusing ratio, being the link rating divided by the full load current of the transformer, indicates the degree of protection afforded the transformer for overloads and high impedance faults.

Surveys of utility practice show a wide variation in fusing ratios being used, with values ranging from 1 to 15 and greater. However, 82% of the utilities surveyed use a ratio between 1 and 7 with the average value being about 3. The lower ratios are an attempt to provide both long time overload and fault protection. The chief disadvantage of this is the resultant sacrifice of the short time overload capabilities of the transformer.

Experience indicates that the probability of transformer burnouts because of long time overloads or high impedance secondary faults does not warrant the sacrifice of short time overload capacity incurred by the use of a low fusing ratio. For a number of years the trend has been toward the higher fusing ratios, protecting the primary feeder against transformer faults and protecting the transformer only against the more severe secondary main or service faults.

Primary Fuses . . . Sizes of transformer primary fuses, applied on the basis of fault protection will fall within certain maximum and minimum limits. Factors determining the minimum fuse size are the degree of transformer short time overload capability to be utilized and the necessity of coordination between the transformer fuse and the consumer's service entrance device for faults on the consumer's premises.

Maximum limit of fuse size is determined by: The maximum secondary fault current the transformer can withstand for a given period of time without injury, and the largest size fuse that will coordinate with the next sectionalizing device back in the system. Within the limits established by the above factors a choice of fuse size is largely a matter of preference.

Primary Feeder . . . Devices used to isolate a faulty portion of primary circuit from the remainder of the feeder are fuses, sectionalizers, and automatic reclosers. These devices, properly applied to a primary feeder, can result in greatly improved service continuity at a minimum cost.

Line Fuses . . . A fuse, being a single operation device, is effective in isolating a fault by blowing and clearing the faulted portion of the circuit. However, about 80% of all faults on overhead open wire circuits are temporary in nature. If the circuit were momentarily deenergized, the fault would clear and remain cleared. For temporary faults, a fuse operation causes a long-time outage to consumers on the affected portion of feeder. This is overcome by the use of automatic reclosers. These permit clearing of temporary faults with a momentary service interruption and lock out only if the fault is permanent.

Multiple-shot repeating fuses may also be used to provide service continuity for temporary faults along with protection against permanent faults. These require close supervision to prevent several consecutive temporary faults from causing a long-time outage by using up all the fuses in the device.

Reclosers . . . In general, reclosers may have their operation set for all time-delay openings and closings or a combination of instantaneous and time-delay. The time-delay operations are necessary to obtain coordination between different size reclosers in the same feeder. In a series of reclosers all set for time-delay operation any recloser will coordinate with all smaller reclosers. This means that a higher rated recloser will not operate at all while a smaller recloser is going through its operating cycle to lockout. The combination of instantaneous and time-delay operations is usually recommended for the last recloser out on a feeder. Instantaneous first trip followed by high speed re-

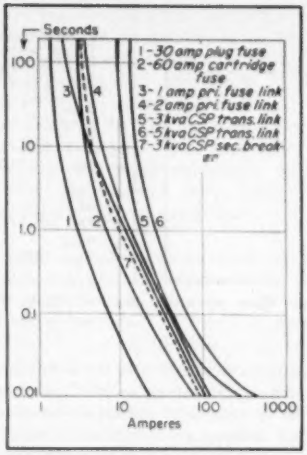


FIG 2—CHARACTERISTIC CURVES for 30 and 60-amp service entrance fuses show coordination required with various transformer devices. Included are curves for 1 and 2 amp primary fuse links

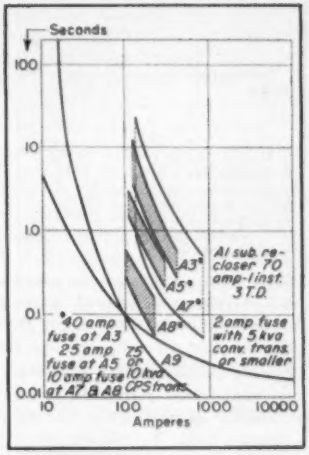


FIG 3—FEEDER A uses fuses throughout for sectionalizing with an automatic recloser at the substation. Curves illustrate coordination from furthest transformer fuse at A9 back to substation recloser

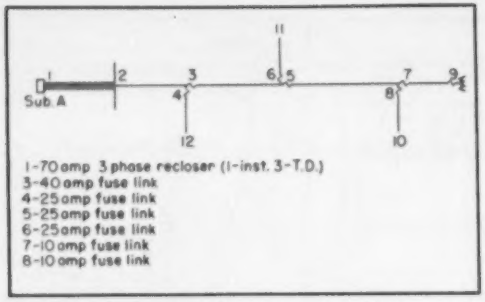


FIG 4—FEEDER A sectionalizing device ratings. Fuses are used throughout with an automatic recloser at substation

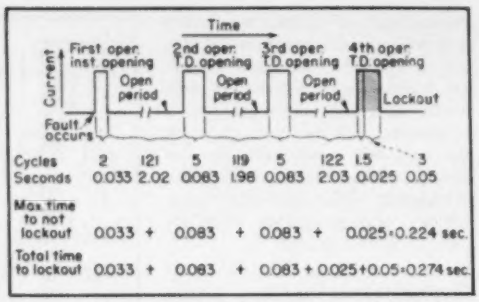

Time
Current
First oper. inst opening
2nd oper. T.D. opening
3rd oper. T.D. opening
4th oper. T.D. opening
Open period
Open period
Open period
Lockout
Fault occurs
Cycles 2 121 5 119 5 122 1.5 3
Seconds 0.033 2.02 0.083 1.98 0.083 2.03 0.025 0.05
Max. time to not lockout 0.033 + 0.083 + 0.083 + 0.025=0.224 sec.
Total time to lockout 0.033 + 0.083 + 0.083 + 0.025+0.05=0.274 sec.

FIG 5—TYPICAL OPERATING CYCLE to lockout for 100-amp recloser set for one instantaneous and three time-delay operations.

closure minimizes system disturbance and holds inrush current to a minimum after an interruption due to a temporary fault. In addition, the recloser can be made to furnish "overlapping protection" to many or all line and transformer primary fuses on its load side. This requires coordination between recloser and fuse links so that for a fault on the load side of any fuse link the recloser will operate initially before the fuse is damaged. If the fault is temporary, it is cleared and the line reenergized on reclosure, thus eliminating a fuse outage. If the fault is permanent, the fuse will be blown before the recloser locks out. The net result is that a temporary fault beyond a fuse will only result in a momentary outage to consumers within the zone of "overlapping protection." A permanent fault causes the fuse link to blow but allows the recloser to reenergize the circuit up to the blown fuse.

Line Sectionalizers . . . Many of the coordination problems in the application of primary feeder sectionalizing devices can be eliminated, along with the continuing cost of fuse replacement, by the use of automatic line sectionalizers. These devices, used in conjunction with automatic reclosers, are operated by a mechanism which counts the operations of the recloser and their supply side. To provide service continuity for temporary faults along with positive isolation of permanent faults, the automatic sectionalizers are set to open during the second or third open period of the recloser. Two of these devices may be used in series with the one nearest the recloser set for the third opening and the furthest one set for the second opening of the recloser. The use of sectionalizers on all branches together with reclosers on the main lines permits the setting of the reclosers for all time-delay operation, preventing unnecessary operations of series reclosers on temporary or permanent faults. "Overlapping protection" is inherently realized by sectionalizers in series with a recloser. Generally the sectionalizers should have the same current rating as their associated recloser. This insures that the sectionalizer will count and trip for all currents above the minimum tripping current of the recloser and that the short time current rating of the sectionalizer will not be exceeded.

In the application of sectionalizing devices to a primary feeder, the main feeder breaker in the primary substation must be considered in the overall coordination problem.

Coordination

The coordination of all sectionalizing devices in a given primary feeder lies within limits set by terminal factors of the distribution system. The upper limit will be the maximum rating of a main feeder switching device which will still coordinate with similar devices in the distribution substation or subtransmission system. The theoretical lower limit will be the minimum rating of sectionalizing device at the distribution transformer which will still coordinate with protective devices in the consumers' service entrances. The practical lower limit may be several times above the theoretical lower limit depending on the relative size of the transformer and the largest single consumer load supplied by the transformer. For larger distribution transformers individual consumer loads are ordinarily such a small part of the transformer capacity that coordination is automatically obtained between the smallest usable primary fuse or CSP transformer breaker and each consumer's service entrance fuses or breakers. Smaller transformers, with as low as one consumer per transformer, require that a check be made on the coordination of these devices.

Service Entrance and Transformer Devices . . . When conventional transformers are used, fuses on the primary side of the transformer must coordinate with the protective devices in the consumers service entrance. Fig 2 shows typical characteristic curves for the 30-amp and 60-amp service entrance fuses. These low voltage fuse curves have been referred to a 7,200-v primary voltage base for direct comparison with primary fuse curves. Curves are shown for a 1-amp and a 2-amp primary fuse link. The 2-amp link is the smallest primary fuse link which will coordinate with both service entrance fuses. This should, in general, be the smallest size link considered for either a 1½ or 3-kva transformer. The 2-amp link with a 3-kva transformer gives a fusing ratio of 4.8 which is high enough not to restrict the overload capabilities of the transformer. With a 5-kva transformer the 2-amp link gives a lower fusing ratio (2.9) but still not so low as to restrict the most usable portion of the transformer's short time overload ability. The 5-kva transformer would be the largest recommended or use with a 2-amp link.

Fig 2 also shows the characteristic curve of the secondary breaker in a 3-kva CSP transformer, illustrating its coordination with both sizes of service entrance fuses.

Line Devices . . . To illustrate the possibilities of coordination between

commonly used line sectionalizing devices and to bring out some of the problems in securing complete coordination, three hypothetical feeders were assumed, as shown in Fig 1. For purposes of comparison the three feeders are considered identical in length, conductor size, loading, and location of taps. Each feeder originates as a three-phase circuit supplied from a 1,000-kva substation. It was assumed that 1500 ft from its substation each feeder branches into three single phase, 7,200-v circuits. The feeder breaker at each substation was considered to be a three-pole automatic recloser, offering the advantages of single-pole opening and reclosing on single-phase temporary faults with three pole lockout on the last opening for permanent faults. Feeder A makes use of fuses throughout for sectionalizing. Feeder B uses an automatic recloser out on the line. Feeder C uses a combination of reclosers, sectionalizers, and fuses. [Figures B and C will be covered in Part II of this article, to be published in a later issue.]

The major problem of coordination will ordinarily involve only these various line sectionalizing devices. The selection of proper transformer sectionalizing devices is usually a part of the problem of applying a transformer to supply a given load. The remaining problem then is to analyze the system to determine if line sectionalizing devices added to a primary feeder or its branches can be economically justified on the basis of substantially improved service reliability. Preliminary location of these devices, before the actual coordination study, will be based on operating records and judgment. Past records will indicate trouble areas ahead of which a sectionalizing device may be desirable. Important or priority loads may dictate location of a sectionalizing device just beyond such a load.

Assigning Ratings . . . There are three things which must be known in attempting to assign coordinated ratings to all proposed sectionalizing devices in a feeder. These are: (1) the maximum fault current to which a device may be subjected, (2) a reasonable minimum value of fault current which a device should be able to recognize and (3) the maximum load current which a device must carry. The maximum fault current is that for a solid fault immediately on the load side of the device. In determining the minimum fault current which a device should recognize, experience has shown that a value of 40 ohms for the resistance of the fault path is a reasonable assumption. The fault location for this minimum value is, of course, at some point further out on the feeder than the device itself.

Feeder A . . . As above stated, this feeder uses fuses throughout for sectionalizing with an automatic recloser at the substation. The curves shown in Fig 3 illustrate coordination from the furthest transformer fuse at A9 back to the substation recloser. The band curves shown for the line fuses represent an upper limit, which is the total time required for the fuse to blow and clear a fault of any given magnitude, and a lower limit or "short time rating," which is the maximum time for which any given current can be applied without damaging the fuse or changing its characteristics. For proper coordination between fuses in a series it is necessary that these band curves do not overlap at any point within the range of fault currents to which both fuses are exposed.

Fuses . . . If it is assumed that the farthest transformer out on the feeder at A9 or A10 will be fused with no larger than a 2-amp link for a conventional transformer or that no larger than a 10-kva CSP transformer will be used, either of these will coordinate with a 10-amp link in either branch at A7 or A8 over a range of fault current from 103 amp to 230 amp. The load current in each of these branches is 5.2 amp so that 10-amp links are adequate to carry normal current in the branches.

The next fuse location at A5 should use a link no larger than the first size above 20 amp which will coordinate with the 10-amp links at A7 and A8. The band curves of Fig 3 show that a 25-amp link meets these conditions over the fault current range of 103 or 230 amp to which both fuses may be subjected in series. At A3 the fuse link must be able to carry the 36.4 amp of load current and coordinate with the 25-amp link at A5. Again, the fuse curves show the nearest size above 36.4 amp which will coordinate is a 40-amp link. Since the branch fuse at A6 must also coordinate with the main fuse at A3, it should not be larger than 25 amp or smaller than 15 amp, its load current requirement being 10.4 amp. Making this A6 link 25 amp allows a greater range of transformer sizes to be used on this branch than would be usable with any smaller size link.

The final sectionalizing device in the feeder, ahead of A3, is the three-pole recloser at the substation. In general any automatic recloser will furnish its maximum benefits when it can be applied to provide "overlapping protection" to one or more fuse locations farther out on the system. With only one recloser on the feeder, a combination of instantaneous and time-delay operations can best be used to secure this "overlapping protection."

Substation Recloser . . . In selecting the substation recloser rating three factors must be considered. One is the full-load rating of the substation transformer. The recloser should not be so small as to open up unnecessarily during reasonable transformer overload conditions and yet not so large that its minimum tripping current is above that which will give some protection to the transformer for severe overloads or high-impedance faults. In general this will limit the minimum tripping current of the substation recloser to somewhere between 2 and 3 times the full-load rating of the transformer. The second thing to be considered in determining the substation recloser rating is the necessity for coordination with the next device back in the system such as high side fuses in the substation or the circuit breaker in the subtransmission circuit supplying the substation. Coordination with these devices and with the devices out on the distribution feeder can generally be achieved with a recloser rating between the limits mentioned above.

Time-Current Curves . . . Several characteristic time-current curves are usually given for each recloser rating. Two curves are necessary to show the time required to trip the recloser, one being for an instantaneous and one for a time-delay operation. Another curve shows the total time that a given current can flow in the recloser during the closed periods of its operating cycle without unlatching the mechanism and causing the recloser to lockout on its fourth operation.

(*Continued on page* 149)

Projections of the Population 1955 & 1960

	1950	Low series		Medium series		High series	
		1955	1960	1955	1960	1955	1960
New England:	**9,393,000**	**9,611,000**	**9,849,000**	**9,898,000**	**10,106,000**	**10,097,000**	**10,759,000**
Maine	930,000	947,000	946,000	968,000	991,000	989,000	1,055,000
New Hampshire	541,000	552,000	552,000	564,000	579,000	580,000	616,000
Vermont	385,000	384,000	377,000	393,000	395,000	404,000	421,000
Massachusetts	4,728,000	4,811,000	4,896,000	4,920,000	5,035,000	5,055,000	5,359,000
Rhode Island	783,000	799,000	800,000	817,000	838,000	839,000	892,000
Connecticut	2,026,000	2,118,000	2,167,000	2,166,000	2,270,000	2,295,000	2,417,000
Middle Atlantic:	**30,517,000**	**31,282,000**	**31,466,000**	**31,989,000**	**32,957,000**	**32,865,000**	**35,079,000**
New York	14,999,000	15,420,000	15,546,000	15,768,000	16,286,000	16,200,000	17,335,000
New Jersey	4,879,000	5,065,000	5,159,000	5,180,000	5,404,000	5,321,000	5,752,000
Pennsylvania	10,646,000	10,798,000	10,755,000	11,041,000	11,266,000	11,344,000	11,992,000
East North Central:	**30,686,000**	**31,941,000**	**33,567,000**	**32,662,000**	**34,117,000**	**33,558,000**	**36,313,000**
Ohio	8,016,000	8,345,000	8,508,000	8,534,000	8,913,000	8,767,000	9,487,000
Indiana	3,983,000	4,151,000	4,236,000	4,245,000	4,438,000	4,361,000	4,723,000
Illinois	8,771,000	9,039,000	9,119,000	9,336,000	9,553,000	9,489,000	10,168,000
Michigan	6,435,000	6,832,000	7,089,000	6,986,000	7,427,000	7,178,000	7,905,000
Wisconsin	3,481,000	3,584,000	3,614,000	3,663,000	3,786,000	3,763,000	4,030,000
West North Central:	**14,339,000**	**14,776,000**	**14,157,000**	**14,650,000**	**14,871,000**	**15,051,000**	**15,785,000**
Minnesota	3,025,000	3,080,000	3,078,000	3,149,000	3,224,000	3,236,000	3,432,000
Iowa	2,659,000	2,667,000	2,631,000	2,728,000	2,756,000	2,802,000	2,934,000
Missouri	4,007,000	4,037,000	3,998,000	4,129,000	4,188,000	4,242,000	4,457,000
North Dakota	631,000	619,000	598,000	633,000	626,000	650,000	666,000
South Dakota	652,000	657,000	641,000	671,000	671,000	690,000	715,000
Nebraska	1,345,000	1,331,000	1,296,000	1,361,000	1,358,000	1,398,000	1,445,000
Kansas	1,921,000	1,936,000	1,916,000	1,979,000	2,007,000	2,034,000	2,137,000
South Atlantic:	**21,171,000**	**22,363,000**	**23,102,000**	**22,868,000**	**24,201,000**	**23,494,000**	**25,760,000**
Delaware	321,000	340,000	351,000	347,000	368,000	357,000	391,000
Maryland	2,336,000	2,508,000	2,605,000	2,564,000	2,750,000	2,635,000	2,927,000
District of Columbia	766,000	805,000	827,000	823,000	867,000	846,000	923,000
Virginia	3,565,000	3,465,000	3,589,000	3,543,000	3,760,000	3,640,000	4,002,000
West Virginia	2,038,000	2,082,000	2,086,000	2,130,000	2,185,000	2,188,000	2,326,000
North Carolina	4,078,000	4,253,000	4,339,000	4,349,000	4,545,000	4,468,000	4,838,000
South Carolina	2,128,000	2,193,000	2,214,000	2,243,000	2,319,000	2,304,000	2,468,000
Georgia	3,458,000	3,540,000	3,552,000	3,620,000	3,721,000	3,719,000	3,960,000
Florida	2,781,000	3,177,000	3,518,000	3,249,000	3,686,000	3,338,000	3,923,000
East South Central:	**11,532,000**	**11,821,000**	**11,870,000**	**12,088,000**	**12,435,000**	**12,419,000**	**13,236,000**
Kentucky	2,951,000	2,996,000	2,985,000	3,064,000	3,127,000	3,147,000	3,389,000
Tennessee	3,319,000	3,445,000	3,509,000	3,522,000	3,669,000	3,619,000	3,905,000
Alabama	3,090,000	3,176,000	3,202,000	3,248,000	3,354,000	3,337,000	3,570,000
Mississippi	2,190,000	2,205,000	2,181,000	2,254,000	2,284,000	2,316,000	2,432,000
West South Central:	**14,573,000**	**15,059,000**	**15,253,000**	**15,399,000**	**15,979,000**	**15,821,000**	**17,008,000**
Arkansas	1,936,000	1,927,000	1,887,000	1,970,000	1,976,000	2,024,000	2,104,000
Louisiana	2,704,000	2,815,000	2,868,000	2,878,000	3,005,000	2,957,000	3,198,000
Oklahoma	2,251,000	2,227,000	2,168,000	2,277,000	2,271,000	2,340,000	2,418,000
Texas	7,683,000	8,090,000	8,330,000	8,273,000	8,726,000	8,500,000	9,288,000
Mountain:	**5,117,000**	**5,465,000**	**5,701,000**	**5,588,000**	**5,973,000**	**5,741,000**	**6,357,000**
Montana	602,000	611,000	608,000	625,000	637,000	642,000	678,000
Idaho	590,000	627,000	643,000	641,000	673,000	659,000	717,000
Wyoming	287,000	300,000	307,000	307,000	322,000	316,000	343,000
Colorado	1,335,000	1,407,000	1,449,000	1,438,000	1,518,000	1,478,000	1,616,000
New Mexico	585,000	744,000	787,000	760,000	824,000	781,000	877,000
Arizona	754,000	849,000	929,000	869,000	973,000	892,000	1,036,000
Utah	697,000	750,000	786,000	766,000	823,000	787,000	876,000
Nevada	158,000	177,000	192,000	181,000	202,000	186,000	215,000
Pacific:	**14,411,000**	**16,307,000**	**17,919,000**	**16,675,000**	**18,775,000**	**17,132,000**	**19,981,000**
Washington	2,348,000	2,554,000	2,709,000	2,612,000	2,838,000	2,684,000	3,020,000
Oregon	1,536,000	1,700,000	1,831,000	1,739,000	1,918,000	1,786,000	2,041,000
California	10,527,000	12,053,000	13,380,000	12,325,000	14,017,000	12,663,000	14,919,000
United States	**151,672,000**	**158,176,000**	**161,679,000**	**161,742,000**	**169,371,000**	**166,179,000**	**180,276,000**

1. Totals differ from sum of parts because of rounding.
2. Figures for 1950 are based on estimates of state population adjusted to represent the civilian population of each state plus members of the armed forces who resided in the area at the time of their enlistment.

Here is the answer to the question . . . .

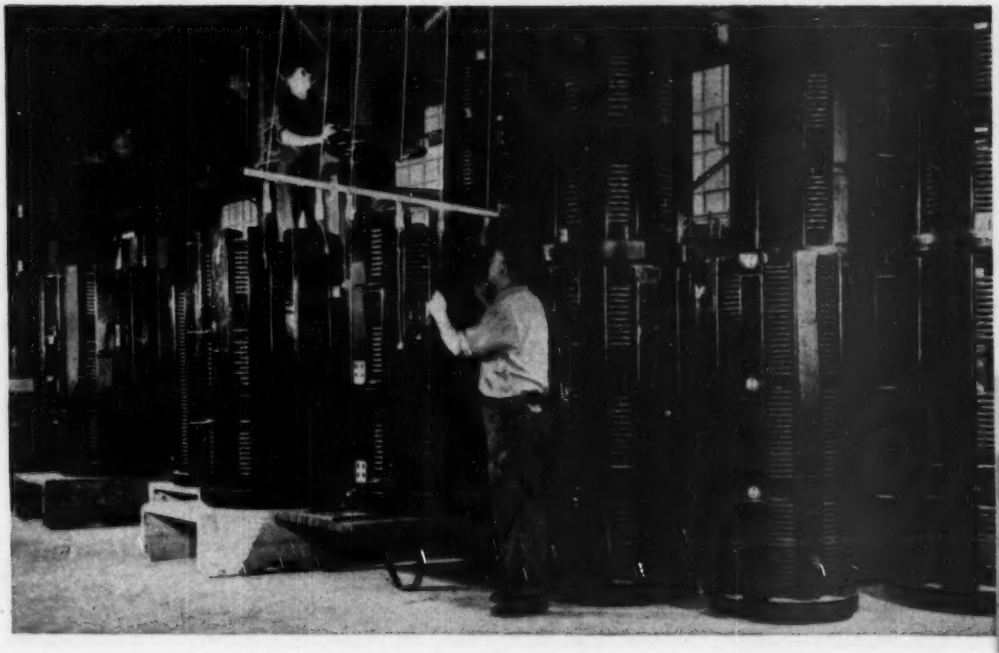
How Many People Will Be Served in 1960?

The wider use of business forecasts has greatly increased the interest in population projections. Planning production and capacity to take care of future demand requires an estimate of the potential market.

Projections presented here were prepared by the Estimates and Forecasts Unit of the Population and Housing Division of the Bureau of the Census. They are designed to represent the civilian population of each state plus members of the armed forces who resided in the state at the time of their enlistment.

A range of estimates is given because it is impossible to predict population accurately. This range indicates the flexibility needed in planning.

Estimates of the future population of any state are made by first projecting total U. S. population. Extrapolated ratios of regional population to total population are then applied to these estimates. Finally the extrapolated ratio of the states population to the regional population is applied.



Now . . . G-E cast-in-concrete reactors delivered in 40 weeks or less

And you get these "extra-service" features . . . results of 35 years of G-E research and development

Today, you can order General Electric cast-in-concrete current-limiting reactors—in existing designs—for delivery in 40 weeks or less.

You get the reactor that results from more than 35 years of continuous research and development. You also get "extra-service" features that help it to outsell all other reactors:

50% greater strength. Concrete supports and conductors form a one-piece rock-like structure. Compressive strength of concrete has been increased 50% in recent years by continuous research on wetsteam curing.

Non-aging glass insulation excels any other type of wound insulation used in reactor manufacture in protecting against turn-to-turn short circuits. It does not deteriorate even under high overloads—remains unaffected by moisture.

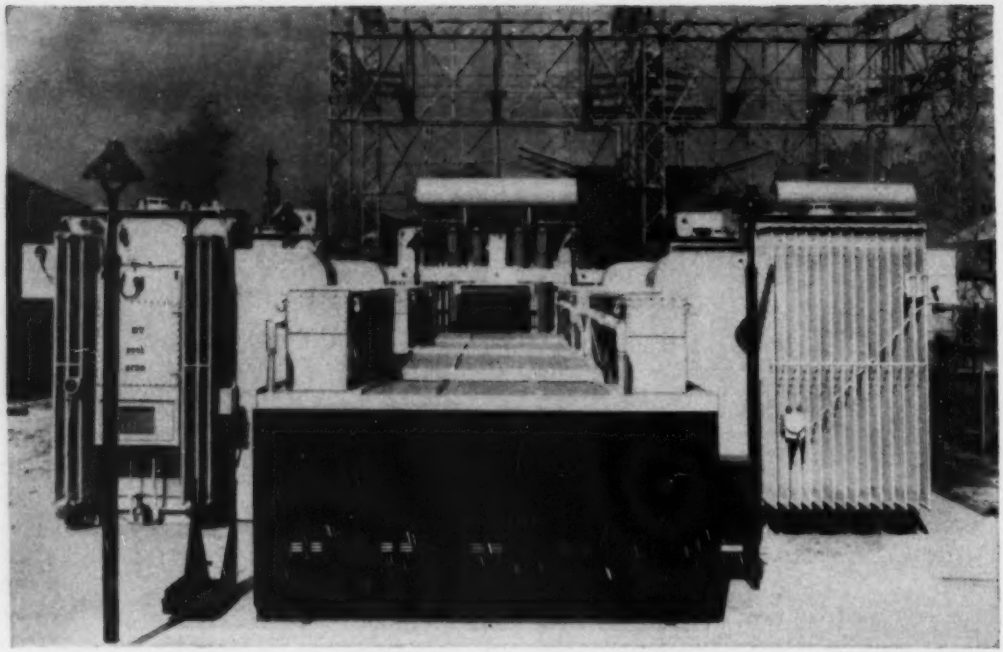
Continually transposed conductors assure more uniform current-distribution. This reduces losses—increases short-circuit strength.

Other "extra-service" features in G-E reactors include: good clearances; crossovers made *within* concrete supports, smooth, flameproof black japan finish; silver-plated terminals.

For full information on when and where to apply these sturdy, dependable cast-in-concrete reactors, call your nearest G-E Apparatus Sales Office. *General Electric Company, Schenectady 5, New York.* 47-118

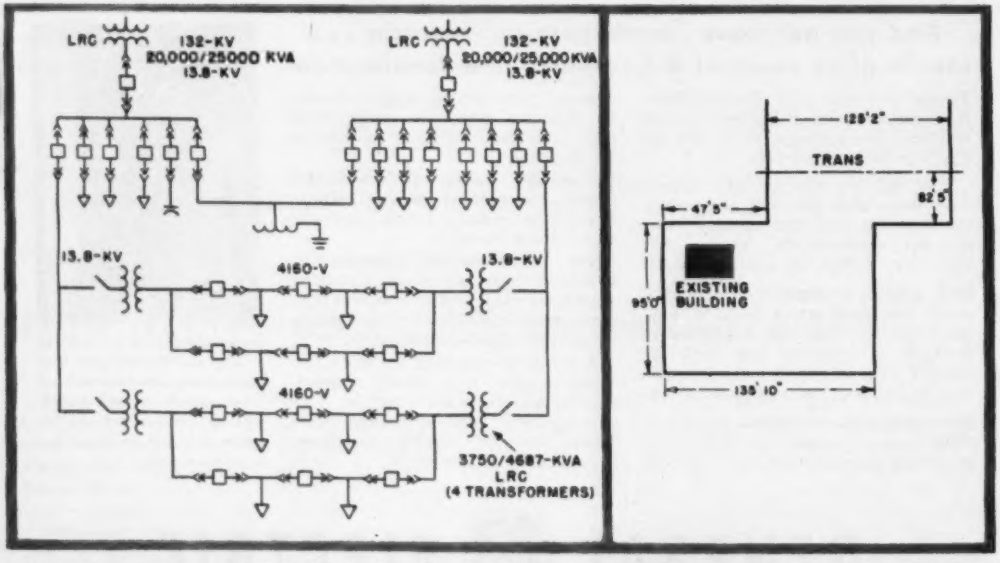
Metal housings can be obtained to match your G-E switchgear. They minimize stray current and electrical losses—protect reactors against external damage. They also increase safety of personnel—improve appearance.

GENERAL ELECTRIC

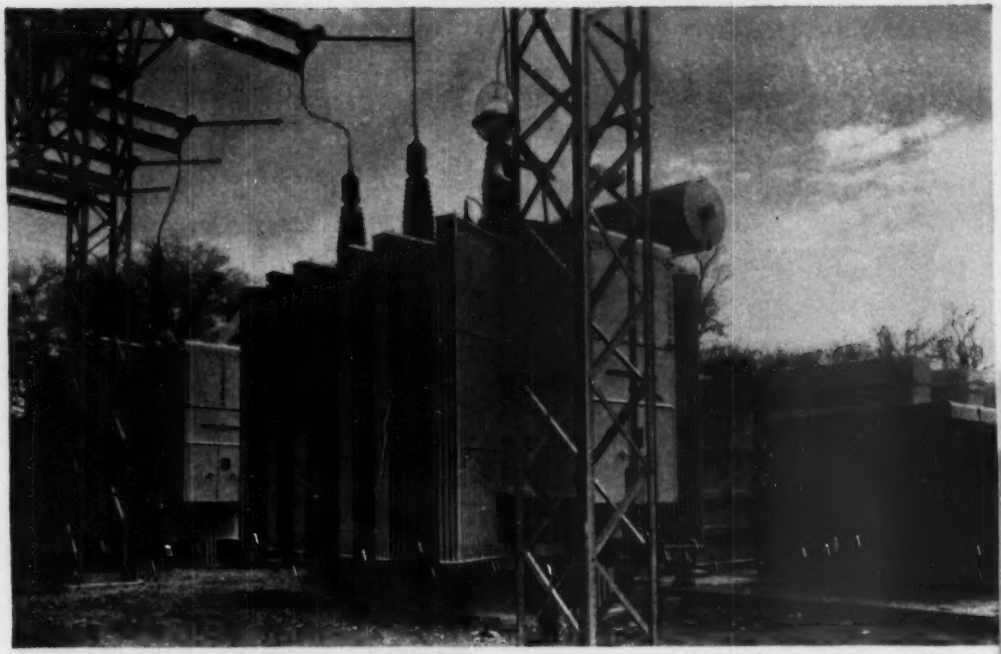


SAN ANTONIO'S 10TH STREET SUBSTATION, one of the largest built by General Electric, is rated at 40,000/50,000 kva, serves its area through nine outgoing 13,800-v feeder circuits in addition to eight 4160-v circuits fed from duplex units.

Utility just draws one-line diagram and



PLANS FOR UTILITY EXPANSION begin with these drawings. A one-line diagram, shown at left, and a simple plot-plan are all that G-E engineers needed to start work on big unit substation for San Antonio. Installation was completed in record time.



LOAD RATIO CONTROL in 25,000-kva transformers provides bus regulation for the 13,800-volt feeders, two of which feed double-duplex units. LRC in duplex units regulates each pair of 4160-v feeders. The substation supplies downtown San Antonio.

plot-plan to specify 50,000 kva substation

An example of fast, low-cost expansion with G-E unit substations.

The 10th Street substation in San Antonio was planned to feed the city's rapidly expanding system. The utility found it had only to furnish General Electric a simple plot-plan and one-line diagram—similar to those shown at the left—to get the job started fast.

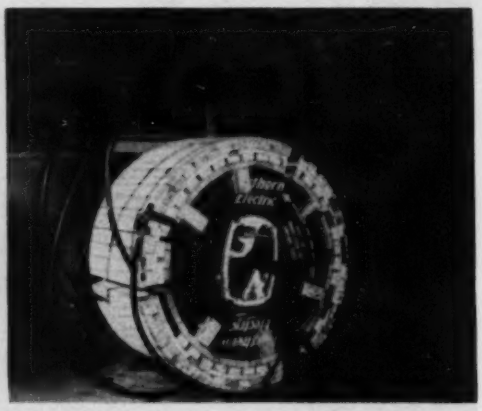
Working from these drawings, General Electric easily and quickly provided a large, double-duplex master unit substation, rated at 40,000/50,000 kva. This standardized equipment answered space requirements as well as the needs of the utility's fast-growing loads.

The City Public Service Board's experience with this G-E substation is further evidence of the trend to standardized equipment in utility expansion programs. G-E unit substations, with their great flexibility, find application in a variety of system arrangements. For full information, write for Bulletin GEA-4500. *General Electric Company, Schenectady 5, New York.* 321-101

BRACKENRIDGE SUBSTATION: One of 30 similar substations installed on San Antonio's system. G-E equipment simplifies expansion.

GENERAL ELECTRIC

OLD COOLING COILS from a 5,000-kva transformer were in good condition after 25 years of service. Single layer consisted of four parallel coils. 2,600 lbs of critical copper were saved



COIL FORMING was done on reel built up to proper diameter with lagging. After three coils of each diameter were formed, lagging was removed for next smaller size. Steel straps in slots held turns in place

Old Copper Coils Reclaimed For Three New Installations

Reclaiming of old copper cooling coils for use in three new 5,000-kva transformer installations saved 2,600 lb of the critical metal for Southern California Edison Co. This operation also made it possible for Edison to get the installations into operation sooner than if it had ordered new coils.

Coils were removed from a bank of four 5,000-kva transformers which had been converted from water cooling to natural cooling. Although the coils had been in service for a long time they were in satisfactory condition. However, it was necessary to form the coils to three new diameters for the new installation.

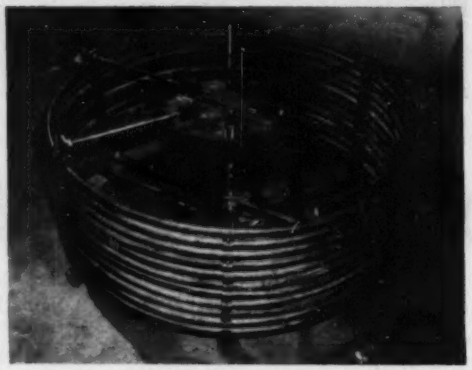
This was done by building up a cable reel with lagging until the proper diameter of the outer set of coils was reached. One end of the coil was held on the reel by a C-clamp and it was rotated until one turn of copper was completed. Then a steel strap was placed in a slot in the lagging under the coil and the turn was bolted to the strap. This procedure was continued until a coil of twelve turns was made.

Coil was formed just loose enough on the reel so that it could be slipped off easily. Three coils of the same diameter were made before the lagging was removed for the next smaller sized coil.

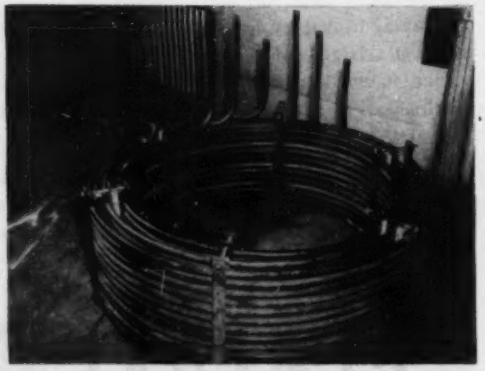
After coils were formed, they were placed in a jig to keep them to a true diameter. Spreader rods were screwed up to accept coils of smaller diameter as they were placed inside larger coils. Wooden spacers were installed to provide recirculation paths and to allow risers.

Before installation, pre-formed copper risers were brazed to the ends of the coils and each coil was hydrostatically tested at 250 psi.

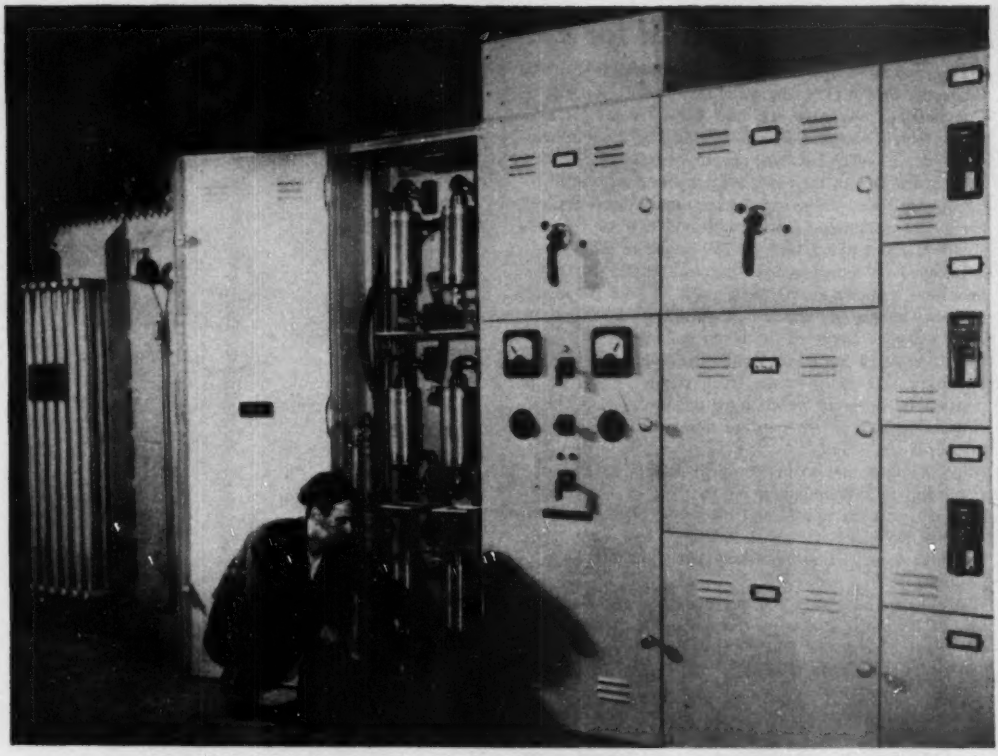
A completed coil consisted of three layers of coils mounted and supported so that field installation could be accomplished readily.



ONE LAYER of new coil was held to true diameter in jig, while smaller layers were being formed. Wood spacers were placed between layers



NEW COOLING COIL for a 5,000-kva transformer consisted of 50-in., 55½-in. and 60-in. diameter coils. Pre-formed risers were attached and coils hydrostatically tested at 250 psi before installation



THIS G-E RECTIFIER AT ALLIANCE HAS REQUIRED NO MAINTENANCE SINCE INSTALLATION IN 1950.

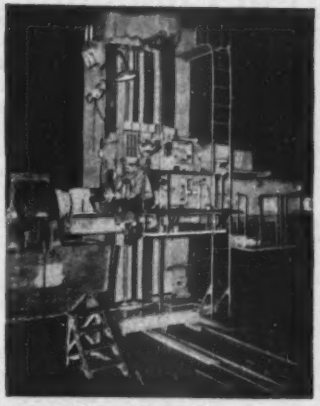
Producer of world's largest cranes uses 300-kw rectifiers for DC power

Alliance Machine Co. gains higher line efficiencies by using General Electric Ignitron Power Rectifiers

In the manufacture of mammoth cranes and other heavy factory equipment, the Alliance Machine Company, Alliance, Ohio, depends on the d-c power from its G-E Ignitron Rectifiers to run hundreds of machine tools throughout the plant.

Installed late in 1950, the mercury arc rectifiers have been in service ever since, requiring no maintenance, with not even a tube needing replacement.

The G-E Ignitron Rectifiers, such as those at Alliance, operate 24 hours a day, 7 days a week. Supplied as a complete packaged unit with transformer and metal-enclosed switchgear, the installation occupies minimum space. For information on a G-E Ignitron Rectifier to fit your d-c power needs, call or write your nearest G-E sales office. General Electric Company, Schenectady 5, N. Y. 324-7



This giant boring mill operates on d-c power supplied by the 300-kw G-E Ignitron Rectifiers at Alliance.

GENERAL ELECTRIC

Design Washing Truck for Ease of Maintenance

Designed for ease of service and maintenance is Southern California Edison Co's new aerial insulator washing truck. Commercially available standard parts have been used extensively in the unit which also will be used for tree trimming and other auxiliary operations.

Main features of the truck are a hydraulically operated telescoping boom, an intercommunications system between the hoseman's platform, truck cab and base of boom, a 1,000-psi water pump, and a 1,250-gal water tank.

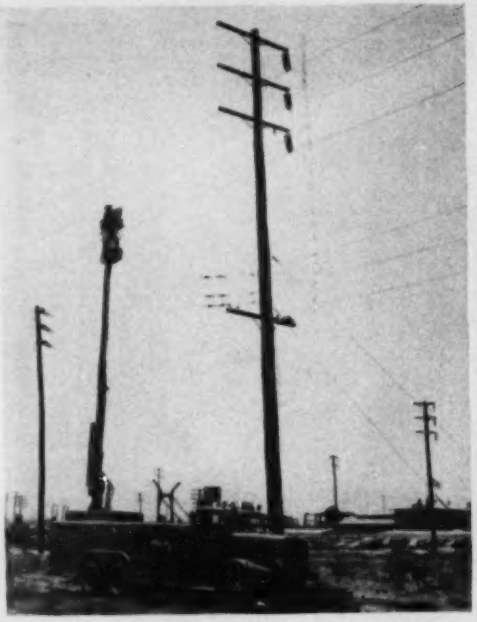
Installed on a turntable at the rear of the truck, the boom has a maximum extended length of 36.5 ft. In this position the washing nozzle is about 42 ft above ground. Fully extended sweep of the boom is 26 ft.

It is powered by a rotary-vane hydraulic pump driven by power take-off from the truck engine. Controls for positioning the boom are mounted on the hoseman's cage. A warning light in the cab indicates when the boom is extended.

To stabilize the boom in rough terrain, a hydraulic stabilizing jack is mounted on the end of a structural outrigger on each side of and below the turntable. Controls for the jacks are linked to the air brake control so that brakes are set automatically while the jacks are in position.

A mechanically operated positive lock between each side of the forward axle on the tandem rear wheels and the frame cancels the spring action and provides a more stable platform for the boom.

A 6-v battery-powered intercommunications system permits conversation through headsets between the driver and the hoseman at all times. An additional telephone jack is provided at the base of the boom for the headset of the supervisor. All fittings, wiring and headset jacks in the intercomm system are of cast aluminum, exterior-type, weatherproof design.



INSULATOR WASHING TRUCK built for California utility can wash up to 60 sets of insulators on one tank of water. Maximum height reached by spray from extended platform is 60 ft

Other features include compartments for various tools and a periscope in the cab roof to allow the driver to observe the hoseman.

Melamine Plastic Has Electric Properties of Costlier Grade

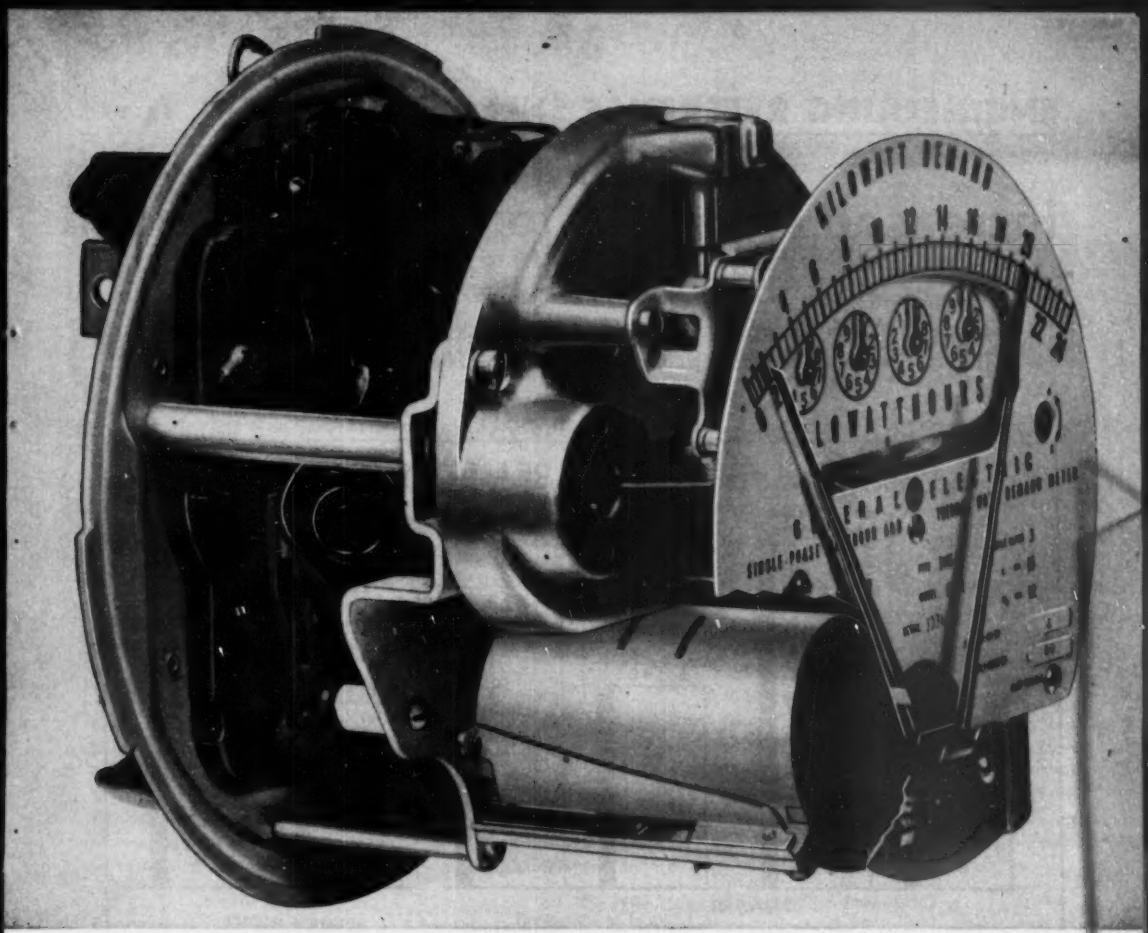
A new grade of thermosetting laminate combines high arc resistance with good mechanical and chemical properties. Designated as G-8, this plastic presents a considerable saving in cost below that of the continuous filament glass base material (NEMA Grade G-5) whose electrical properties it appears to equal. This G-8 was developed by Synthane Corp. of Oaks, Pa. and is being used in bus transfer switches for military applications.

The new material, laminated in thicknesses from ⅛-in. upward, uses a glass fiber mat impregnated with melamine resins. Thus its mechanical properties are less directional than those of a woven-base laminate. Also typical of mat-based laminates is its ability to machine readily to a smooth surface. Mainly, its lower production cost reflects the elimination of the weaving operation.

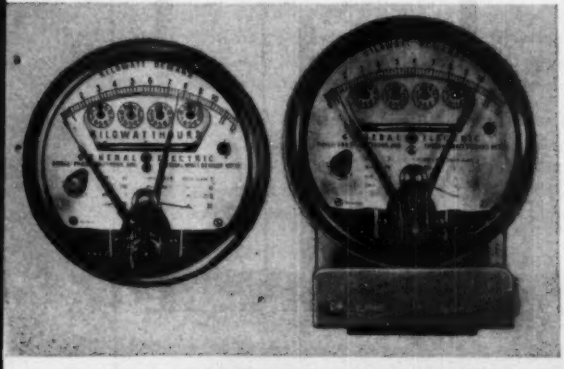
Compared in the Synthane Corp laboratories with GLCC-M or G-5, the new G-8 showed electrical properties approximately equal and mechanical strengths about two-thirds as great. Average values obtained in this test program are listed in the accompanying table.

Average Property Values by Laboratory Test

Property	Amount
Flexural Strength, psi	
Lengthwise	30,000
Crosswise	30,000
Impact Strength, ft-lb per in. notch	
Edgewise, lengthwise	7.0
Edgewise, crosswise	6.0
Bonding Strength, lb.	1,500
Dielectric Strength	
Parallel to laminations, kv	45
Perpendicular to laminations, vpm	200
Water Absorption, %, 24 hr.	
1/16 in.	2.0
⅛ in.	1.75
½ in.	1.50
Dissipation Factor, D-24/23	0.032
Dielectric Constant, D-24/23	6.7
Volume Resistivity, C-96/35/90	25,000
Surface Resistance, C-96/35/90	250
Arc Resistance, sec	130-180



Direct-heat Unit of Watthour Thermal Demand Meters Helps Assure Lower Maintenance Costs



TWO TYPES AVAILABLE in three current ratings: 15- or 50-ampere meters or 2.5 amperes for use with instrument transformers.

Lower maintenance costs are assured with General Electric's Type IHM watthour thermal demand meters because the thermal element operates on a "direct-heat" principle. This produces higher efficiency and thus a greater torque which permits the use of larger, sturdier parts. It also eliminates heat transfer. Result: greater reliability.

ECONOMICAL, ACCURATE MEASUREMENTS. The pointer will not overshoot on a transient load, response time can be easily predicted, and shorter testing times are possible. Type IHM meters incorporate such I-50 features as retarding magnets die-cast in the frame for added stability.

1 METER DOES 2 JOBS. Type IHM meters measure both kilowatt hours and kilowatt demand . . . and fit all standard meter installations. For complete information, call your G-E representative today or write Section 601-86 for bulletin GEC-1007. General Electric Co., Schenectady, New York.

GENERAL ELECTRIC

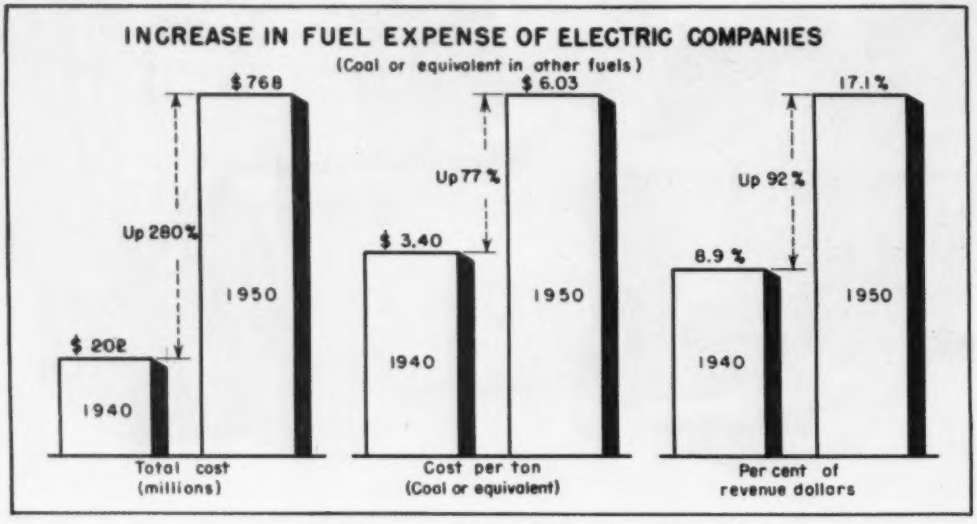
601-86

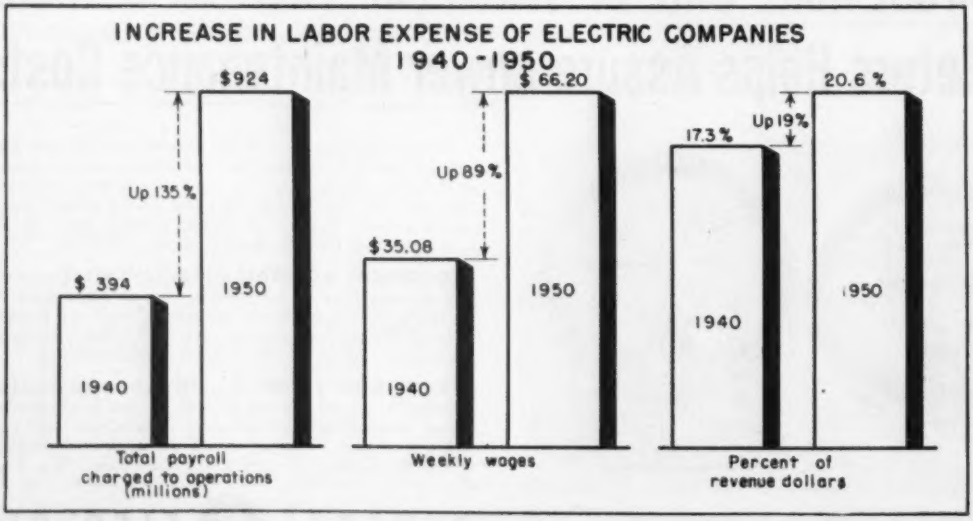
ENGINEERING REFERENCE SHEET

No. 52-17

Increased Expenses for Fuel and Labor

Relative rises in expenses and in percent of revenue dollar are shown for a decade, 1940-1950, based on cost of fuel and payroll charged to operations of electric utilities. Charts are adapted from data compiled by Ebasco Services Inc, New York





How you can use RM-ASA Power Transformers where "specials" seem to be required

...and get several months faster shipment and up to 8% lower price

Many power transformer applications require voltages, impedances, and tap arrangements which apparently can be provided only by non-standard transformers. Often, you can meet these requirements with G-E RM (Repetitive Manufacture) transformers which conform to the new ASA standards. At the same time, you obtain attractive savings in both time and money. For example, with RM-ASA Transformers...

YOU CAN OPERATE AT NON-STANDARD VOLTAGE:

One optional feature of RM-ASA transformers provides that the high-voltage rating for each insulation class above 5 kv can be varied over a 20% range. This means, also, that by under-exciting you can obtain secondary voltages other than EEI-NEMA Preferred Voltage ratings. There may be some sacrifice in rating, of course—but you will get more kva per dollar than with a special transformer.

Example: You have a standard 34.5-kv primary, but want a non-standard low voltage of 2300. Select an optional RM-ASA rating of 36 to 2.4 kv. Operate at 34.5 kv. You'll get your 2300 volts.

You pay 1% for the optional high voltage. You save 8% in base price. You get faster delivery.

YOU CAN GET ALL TAPS ABOVE OR BELOW THE ACTUAL PRIMARY VOLTAGE:

With RM-ASA transformers, you get two taps above and two below the rated primary voltage. By selecting an optional primary rating, you can get all four taps above (or all below) your actual line voltage.

Example: Your high voltage is 34.4 kv. You want all taps below this. By selecting 32.8 kv for the primary rating, you get taps at 34.4, 33.6, 32.0 and 31.2 kv.

You pay 1% for the optional voltage. You save 8% in base price. You get faster delivery.

YOU CAN PARALLEL TRANSFORMERS WITH DIFFERENT IMPEDANCE:

Impedances of RM-ASA transformers are fixed at 5.5% to 7.0%, depending on high voltage. While this affects division of load when an RM-ASA unit is paralleled with an existing transformer, it is not as critical as you might think. It seldom results in a serious loss of capacity.

Example: You want to parallel a 34.4-kv RM-ASA transformer (impedance, 6%) with an existing unit having an impedance of 6.6%. Theoretical division of load is about 52%—48%. Often actual division will be even better than this because of external impedances. At worst, you have lost less than 5% in capacity. You have saved 8% in cost, gotten faster delivery.

YOU CAN PARALLEL △-Y WITH Y-△

While in most ratings, RM-ASA transformers are available as △-Y or △-△, a △-Y RM-ASA transformer can almost always be paralleled with an existing Y-△ unit. In fact, there is one advantage: You can ground the high side through the old unit, the low side through the new RM-ASA unit.

YOU HAVE 20 OPTIONS AVAILABLE:

These include: optional primary voltages—load-ratio-control—bushing current transformers—fans or provisions for future fans—junction boxes, and many others. RM-ASA power transformers are available in ratings up to 5000 kva single-phase and 10,000 kva three-phase. The ratings cover all EEI-NEMA Preferred Voltages—high and low—69 kv and below.

Let us help you apply RM-ASA transformers. For additional information, contact your nearest G-E representative. *General Electric Co., Schenectady, N. Y.*

401-33

GENERAL ELECTRIC

SAFETY TAGS protect men working on de-energized lines and equipment. Release order (center) is attached to master control point of equipment and carries details of work being done. Release notice (right) is supplementary tag used at all but master control points. Release permit is used to tell operator that equipment is clear and ready for service.

Eight Rules for Safe and Efficient Tagging

1. Make scheme applicable throughout entire system and broad enough to cover every condition
2. Keep within limits of easy understandability and reasonable simplicity of use
3. Provide one type of tag for each function and use separate colors for different functions
4. Supervise scheme rigidly through responsible authority
5. Enforce rule that all lines and equipment must be considered energized unless designated otherwise
6. Use written instructions to cover use of tags. If instructions cannot be applied to a certain practice, either instructions or practice should be changed
7. Provide workable scheme from viewpoint of load dispatcher and workman in field
8. Have load dispatchers and operators keep written records of switching and tagging operations

T. C. MONTGOMERY, West Penn Power Co, Pittsburgh, Pa.

Protect Men and Equipment With Safety Tags—I

Safety tagging of lines and equipment on the West Penn Power System has met these principal requirements for 25 years—Protection of men at work under all conditions; protection of equipment from damage; and designation of abnormal conditions.

During the time that this scheme has been used there have been no accidents or errors because of failure or inadequacy of the scheme itself. There have been operating errors because of human failures, such as improper placing of tags, but even these amounted to less than 2% of all errors over the system. Since its development there have been only minor revisions to the scheme.

The tagging scheme is based on the eight rules in the accompanying listing. These rules are made effective by the use of six colored tags and a set of operating instructions. Color combinations were chosen after a color blindness and color selection test was given to employees charged with operation of the system.

Adapted from a paper presented before the Systems Operation Committee of the Pennsylvania Electric Association.

Tags are of shipping-tag style and measure about 3 x 6 in. Each has a string for attaching to equipment. For attaching tags to energized electrical equipment, standard insulation tag holders attachable by a disconnect stick are used. In some cases, tag holders are permanently attached to equipment operating rods. Use of wire or any means other than those provided is prohibited.

On the back of each tag is printed a brief summary of rules covering its use. All tags must be filled out completely before being placed, except under certain emergency conditions specified in the tagging instructions.

Release Order . . . A pink tag with deep blue printing is used to protect men at work on de-energized lines or equipment. Lines or equipment covered by this tag are said to be "released from service" and persons working under it are said to have obtained a "release." Use of the more common term "clearance" is avoided to prevent confusion with the universally used expression "report clear."

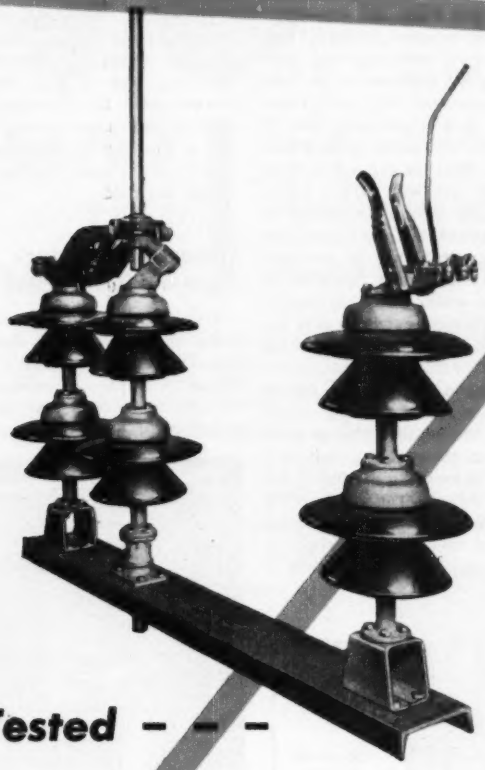
Space is provided on each release order tag for recording a release number, station name, date, time, and line or equipment covered. In addition, person to whom issued, person placing, person ordering, and reason for placing can be recorded. Release order tag is never issued on any energized line or equipment. Lines or equipment upon which release order tags alone are placed are never energized or operated by any person until all persons holding releases have reported clear. A release on electrical equipment is not issued until a visible opening has been provided to each possible source of energy and all such openings have been properly checked and tagged.

Because the release order tag is used only to protect men at work, the individual to whom release is issued must report clear when not working, even though his work has not been completed and the line or equipment is not available for service. Each release is issued to only one person who, until he reports clear, is responsible for the safety of all persons under his supervision.

If a second person desires to work

Your best buy

and the standard of comparison!



Tested – – –

Proved – – –

Accepted – – –

DELTA-STAR'S "MK-40"

Delta-Star has for years as a standard routine practice tested all switches, both for normal current carrying capacity and for short time rating, before placing new designs in production. Delta-Star has *never* designed and placed a switch in production purely on a calculated basis.

With exceptionally large and extensive laboratory facilities for testing at the factory, Delta-Star has nevertheless had instances where the capacity of the switches exceeded these facilities. In such cases the switches were tested elsewhere . . . but they were *always tested!*

That is why we *know* that *all* Delta-Star Switches rated 400 to 5000 amperes will meet the NEMA guaranties as to normal rating and short time rating. Proving the adequacy of design by actual tests has been routine practice with Delta-Star for many years . . . and this is simply another reason why the MK-40 has won universal acceptance by operating engineers and is *your best buy.*

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHES SPECIFY THE "MK-40"

DELTA-STAR ELECTRIC COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

2437 Fulton Street • Chicago 12, Illinois

DISTRICT OFFICES IN PRINCIPAL CITIES

on the same equipment and cannot work under the first, he must obtain a separate release in his own name. If the holder of a release desires to have his work continued by another person he must report clear. A new release is issued to the other person.

The only exception to this rule concerns equipment removed from service for work over an extended period of time. Someone working in a position which continuously succeeds itself, such as shift electrician in a power station, may continue to hold the release issued in the name of the position.

Release Notice . . . A red tag with black printing is used as an auxiliary tag to eliminate burdensome recording of details. It is used at all points except the master control point of a line at each station or the master control point of equipment in a station. This tag requires only the recording of release order number, station name, person to whom release is issued and equipment to which it is attached.

Release notice tag is never used alone. It is used only with a release order tag. As a check that equipment is properly covered by release notice tags, there is a space on the back of the release order tag in which is noted each point at which a release notice tag is attached and total number attached. The fact that release notice tags are removed also can be noted.

Release Permit . . . This thin yellow paper with black printing is issued as an additional check when a release is issued on station equipment at attendant stations. The release permit tag is given to the person obtaining the release to indicate the equipment upon which he may work. The release permit tag must be signed and turned over to the operator when reporting clear.

This tag is a duplicate of the front of the release order tag. It is printed on paper with a gummed edge by which it can be attached to the release order tag. Thus the two can be filled out at one time with carbon paper. This not only reduces the amount of writing required, but also insures that the release permit will be an exact copy of the release order. Space on the back of the release permit tag permits the person reporting clear to state the equipment condition and sign his name.

At attendant stations, the person obtaining the release covering station equipment accompanies the operator to see that all switching and tagging is performed properly before the release is issued. This rule covers other safety tags in the station and the returning of equipment to service. It is the responsibility of the operator to see that this rule is enforced.

The three tags just described actually are variations of one type designed for a single function—to protect men at work on de-energized lines and equipment. However, use of these three forms eliminates the duplicate recording of many details and gives considerable flexibility to the tagging scheme.

The second part of this article, to be published in a subsequent issue of Electrical World, will describe three other tags used by West Penn—the caution order; the operating permit; and the construction order. In addition, a filing system and other safety features of the safety tagging scheme will be discussed.

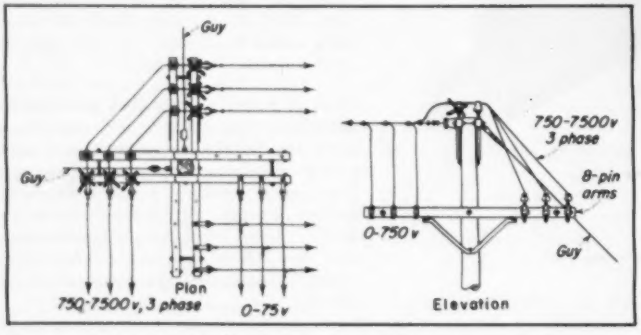
Choose Connectors From Rods in Basket

Split-bolt connectors carried in a basket make it easy for linemen of San Diego Gas & Electric Co to choose the proper-size connector while working in gloves at pole top. Steel rods hold up to ten connectors each

SPLIT-BOLT CONNECTORS in self-service basket are chosen easily by linemen working in gloves. Ten each of five sizes provided

in five sizes ranging from No. 6 to 1/0. Rods of different diameter prevent the mixing of sizes.

Basket consists of rubber belting mounted and tacked to a wood disk. A swivel hook in the hand line connection allows the lineman to rotate the basket when choosing a connector. Two hooks are provided for rolls of friction tape. Strips of varnished cambric hang from the basket on a wire loop. They are wrapped over the connection before the tape is applied so that a connector salvaged for reuse is not sticky.



Save Six Insulators on Primary Corners

Elimination of six insulators and six steel pins on 60 to 90-deg angle construction is saving California Electric Power Co about $3.50 per corner. As shown in the illustration, the insulator and pin are replaced with a steel bolt which holds the clevis of the dead-end insulator. The new construction standard for lines 750 v to 7,500 v, three-phase, was suggested by similar practice for construction at higher voltages. A secondary advantage of this construction is that linemen have to tie conductors to six less insulators, according to H. M. Williams, Inspector of Overhead Lines.

NO. 7 IN A SERIES

AN EQUIPMENT MANUFACTURER ASKS—

"How can we purchase transformer bushings more economically?"

here's the answer:

Specify standard Pinco Bushings. The two Bushings shown here, are typical of the many standard types available in the Pinco line.

If you are a manufacturer of equipment requiring the use of low voltage, high current bushings, chances are you'll find just what you need in Pinco's line of standard Bushings. These Bushings, made by the famous Pinco wet plastic porcelain process are equipped with standard terminals (or terminals to your specifications) and are furnished completely assembled with necessary hardware ready for mounting on transformers or other applicable equipment.

Refer to Pinco catalog No. 49 for complete specifications on standard bushings . . . or contact us or the nearest Joslyn office.

IF YOU REQUIRE "CUSTOM-MADE" PORCELAIN . . . we are equipped to make it to your exact specifications. Quotations on Pinco special porcelain are made from your blue print or sketch. And if you wish, our engineering department will assist you in designing the porcelain you require.

The Porcelain Insulator Corporation
LIMA, NEW YORK

Sales Agents: **JOSLYN MFG. & SUPPLY CO.**
Offices in Principal Cities

Methods of Monitoring Transformer Loads

Method	Advantages	Disadvantages
A. Split core Ammeter	Numerous tests can be made on selected transformers.	1. Reading is for an observed interval and may be quite different at peak. 2. Duration of load must be approximated.
B. Thermal Ammeter	Gives an integrated peak load.	1. Duration of load must be approximated. 2. Many devices required. 3. Requires two trips to each transformer.
C. Graphic Ammeter	Gives load and duration.	1. Many devices required. 2. Requires two trips to each transformer.
D. Waxes and Paints	1. Can be applied to large group of transformers. 2. Gives approximate top oil temperature.	1. Requires systematic patrol by circuits. 2. Life of material questionable.
E. Signal light actuated by a bimetallic strip in top oil	1. An accessory on new transformers. 2. Relatively inexpensive.	1. Requires systematic patrol from office records. 2. Cannot be applied to old units.
F. Buzzer signal actuated by a thermal element in top oil	1. Can be applied to all transformers. 2. Relatively inexpensive. 3. Automatically monitored by customers. 4. No calculations required. 5. No office records required.	1. Short interruption usually desirable when installing.
G. Self-Protected Transformer with thermal circuit breaker	1. Realizes maximum capabilities without burnout. 2. Preliminary red light on approaching capability. 3. Part of new transformers.	1. Overload would trip customer during heaviest load period. 2. Red light may require patrolling from office records. 3. Internal transformer drop may force its replacement prematurely. 4. Cannot be applied to existing units.
H. "Ideal" Alarm actuated by a hot spot relay which starts a buzzer	1. Alarm can be set somewhat below capability but responding to hot spot temperature. 2. Automatically monitored by customers. 3. Can be installed on any or all transformers. 4. No patrols required. 5. Alarm can be ignored until next day. 6. Load relief can be studied without danger of damage to transformer. 7. Voltage drop less than self-protecting type.	1. Does not realize full capabilities. 2. Occasional burnouts might result if alarm is unheard by the customer.

Methods of Monitoring Distribution Transformers

A. F. SEDGWICK, Electrical Engineer, The United Illuminating Co, New Haven, Conn.

How far should we go in loading transformers? How can the loading of thousands of distribution transformers be adequately supervised?

Each transformer has a nameplate-rated kva, meaning at 30 C average ambient and 40 C maximum ambient, the transformer can deliver that rated kva continuously without exceeding 95 C hot spot temperature for Class A insulation. But according to ASA C57.3 guides, many transformers are loaded to their thermal capacities and their peak loads often reach 200% of nameplate rating. At these loadings, more adequate supervision is required.

The table lists the methods commonly used, with their advantages and disadvantages.

In the New Haven area, 12 transformers were equipped with the hot oil temperature actuated buzzer (item F). This 120-v buzzer, mounted inside the transformer, is actuated by a thermal fuse link which melts when the oil temperature exceeds the link's rating.

Of the 12, three transformers melted the replacable thermal links, rated at 65 C, and were promptly reported by customers who heard the noise from the internally mounted buzzer. Further measurements and calculations on these three transformers showed top oil temperatures of 62 C, 78 C and 98 C, the last indicating a heavy overload. The hot spot temperatures were calculated to be 96 C, 125 C and 155 C, respectively.

Although these buzzers do not "see" the hot spot temperature, calculations of residential distribution transformers for varying peak load and ambient temperatures show the devices would be a satisfactory way of monitoring residential transformers in the New Haven area.

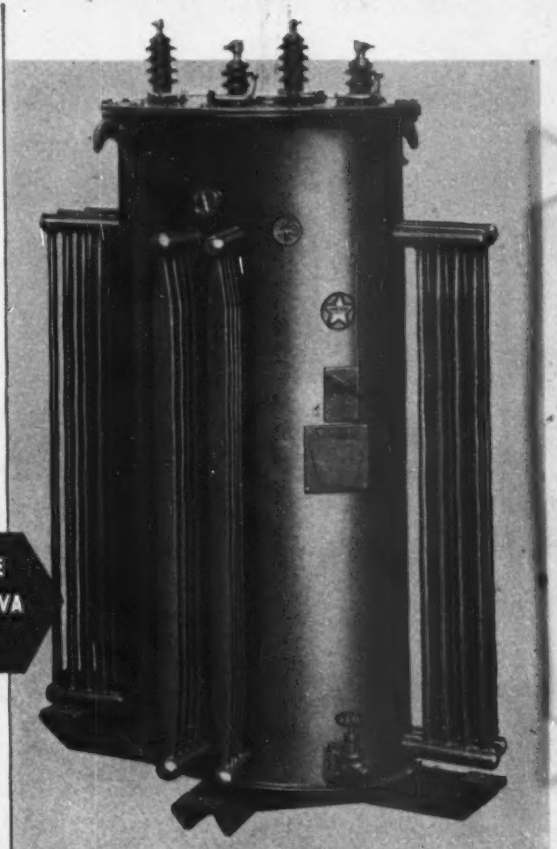
Other types of load and climate might make other methods more satisfactory. For general use or for power banks a hot spot alarm device would perform better because the power load bears little relation to the season of the year.

The problem of transformer loading and monitoring is one of increasing seriousness for public utility companies and merits serious consideration. Millions of dollars are invested each year in transformers, and these millions must be invested wisely. Utility men should search for an ultimate solution that will assure better service for less dollars.

A TON of Copper, Oil and Steel saved in NEW 500 kva POLE STAR

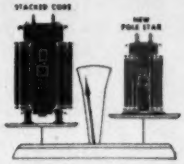
YES, the new 500 Kva Pole Star weighs 2200 pounds less than the 500 Kva stacked core transformer it replaces. This means that vitally-needed supplies of copper, steel and oil are saved in the manufacture of Pole Star transformers without sacrificing any of the efficiency or life of these transformers. On the contrary, the smaller and lighter-weight Pole Star transformers are more efficient and more economical to operate, in addition to being less costly to store and easier to install.

Pound for pound and inch for inch, the Pole Star delivers more Kva than hot-rolled steel stacked core distribution transformers. This means you can replace your small Kva transformers with larger Kva Pole Stars with little or no increase in size or weight, and, in most cases, at very low changeout cost.



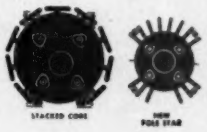
HERE'S HOW THE NEW 500 KVA POLE STAR COMPARES WITH THE OLD 500 KVA STACKED CORE TRANSFORMER

Exciting Current reduced 75%



Weight reduced 2200 pounds

Oil Volume reduced 35% 125 gallons



Floor Area reduced 20%

PENNSYLVANIA POLE STAR TRANSFORMER

Pennsylvania TRANSFORMER COMPANY

BOX 330, CANONSBURG • PENNSYLVANIA

Greater Pittsburgh District

Meeting the Nation's Growing Power Load

Size no longer a barrier to Transformer Capacity

On paper, there's no limit to the capacity that can be built into a transformer. The prime stopper . . . size! Economical transmission of big blocks of power at higher voltages requires large transformers, that tax the capacity of ordinary manufacturing facilities and transportation to deliver them. The problem then . . . to boost capacity, but hold size and weight to deliverable limits.

More than a year ago, Westinghouse achieved a new peak of 145,000 kva. Recently, Westinghouse engineers raised the ceiling to 150,000 kva at 220 kv . . . in a Form-Fit unit. Form-Fit transformers can always be shipped more completely assembled.

End of story? No indeed! Transformer research, to keep pace with higher rated turbine-generator units, has been under way at Westinghouse for twenty years. Problems of weight and size are being solved as evidenced in the construction of a 190,000-kva transformer . . . within practical size, weight and cost limits. And . . . further than this . . . 220,000-kva Form-Fit units are even now on order and being designed and still will be shipped *factory-assembled*. Still greater capacity is on the way as the result of developments now in the laboratory stage.

This story of how Westinghouse engineers licked a tough problem is really a series of painstaking, individual development stories, all tied together by a keen insight into your needs today . . . tomorrow. You can count on this Westinghouse "thinking ahead" for all phases of utility service . . . it's keyed to the ever-changing, ever-growing needs of your system. J-97163

YOU CAN BE SURE...IF IT'S

Westinghouse

Form-Fit Power Transformers

A Westinghouse innovation in basic design of large power transformers is Form-Fit construction. Pancake-type coils are mounted vertically with large parallel cooling ducts. The core, stacked through and around the coils, forms a protective shell with advantages in both mechanical and electrical strength. The large plate area of the coils results in distribution of lightning surges across the winding, eliminating the need for special shields, arresters, or other internally mounted protective devices. Because short circuits set up magnetic fields that tend to force high- and low-voltage coils apart, Westinghouse Form-Fit Transformers are arranged with high- and low-voltage coils interspersed, so that these forces actually work against each other. The Form-Fit tank slips down over this compact unit. Increased cooling efficiency of this design, plus more compact construction and lighter weight, makes possible ratings heretofore impractical . . . results in installation savings.

Network Transformers

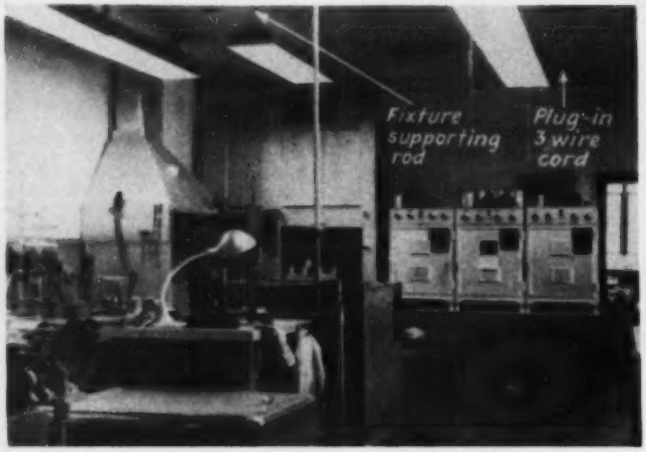
In conjunction with a progressive utility group, Westinghouse pioneered the first secondary network installation in 1922. Since then Westinghouse has made important contributions to every major development in network transformer design, including the first three-phase units, the first low-loss, oil-immersed transformer, the first ventilated, Class B, dry-type transformer for indoor network service, and the first sealed, Class H, dry-type transformer for submersible and hazardous installations.

CSP® Distribution Transformers

Another development that has brought new operating economies to power distribution is the Completely Self-Protecting Transformer. It combines a distribution transformer with all its protective devices, factory-co-ordinated. These devices include H-V "De-ion®" arresters, protective links, and L-V thermal breaker complete with signal light and emergency control handle. These features protect against lightning, line lockouts, secondary short circuits, and transformer burnouts from overloads. In addition, they provide an automatic load check and permit emergency operation when required . . . assuring better continuity of service.

For information about these and other transformer developments, call your Westinghouse Electric Utility representative . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Penna.

INDUSTRIAL APPLICATIONS



FLEXIBILITY and lower rewiring costs feature this laboratory modernization job. Fluorescent fixtures plugged into duplex 3-wire receptacles installed in existing ceiling outlets save on branch circuit wiring and provide suitable grounding. Rods through ceiling support fixtures

Plug-In Lighting Fixtures Reduce Cost of Modernization

WILLIAM G. DARLEY, Consulting Engineer, Austin, Texas

The use of plug-in type fluorescent fixtures in the modernization of the electrical system in the Materials and Test Laboratory of the Texas Highway Department at Austin, saved branch circuit wiring and permits relocating fixtures if and when laboratory arrangements are changed.

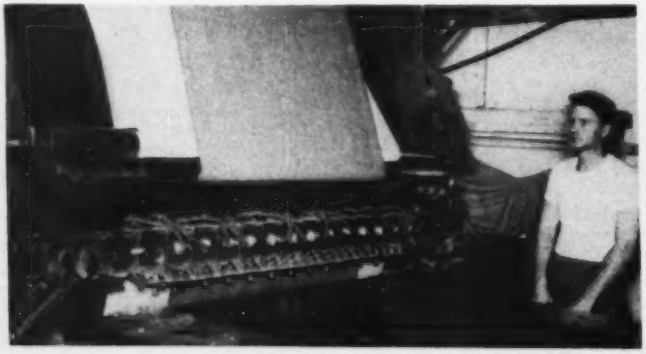
The new fixtures are supported with rods extending through the composition board ceiling and on through 2 x 4's resting on the attic floor joists. Thus it is a simple matter to relocate a fixture. All fixtures are independently grounded at outlet boxes by the third wire of the plug-in cord and 3-wire ceiling receptacles.

Due to the random location of work spaces and the probability of their future rearrangement, it appeared desirable to design for good lighting with units on regular centers; however, because of the presence of equipment which would interfere with continuous runs and a desire to keep costs down, it was decided to lay out the lighting on the basis of the location and needs of specific work areas. At the same time, the probability that the arrangements in the labs would be changed was recognized by not connecting the fixtures to branch circuits via permanent connections at ceiling outlets. Instead, ivory-finished, twist-tight duplex receptacles were installed in ceiling outlets and the lighting fixtures were equipped with three-wire cords and plug-caps. The caps are merely "plugged in" to the nearest ceiling outlet. In general, use was made of existing ceiling outlets for the installation of the duplex receptacles so that the branch circuit wiring for the lighting fixtures did not involve completely new branch circuit layouts.

The laboratory work results in the creation of fumes, dust, and dirt, some of which inevitably escape into the rooms, despite the operation of ventilating hoods. For this reason, the use of industrial fixtures was indicated. At the same time, a higher degree of comfort was called for than is provided by this type of fixture; therefore, it was specified that the fixture should be equipped with a longitudinal louver, in addition to closed ends.

Lighting in the general office was changed from bare lamp fluorescent fixtures to continuous rows of two-lamp, aluminum sided units installed on 7-ft centers. The private offices were lighted with four-lamp louvered units, located with reference to desks insofar as possible.

After several years of service, the engineers and technicians in the Laboratory express themselves as being well satisfied with the brightness ratio and brightness conditions. Footcandle levels range from 40 to 60.



Provide Uniform Heat For Sanforizing

Even heat distribution necessary in the sanforizing process to dry and set cloth rapidly is provided by electric cartridge elements used at Cold Spring Bleachery, Yardley, Pa. Elements are cast in steel shoes and mounted in a line across a steam heated roller. Four 185-w elements are in each shoe. Thermostat controls temperature of each shoe. Cloth passes between roller and line of shoes. L. Albertson, Application Engineer, Philadelphia Electric Co.

Induction Heat Cuts Hardening Costs 48%

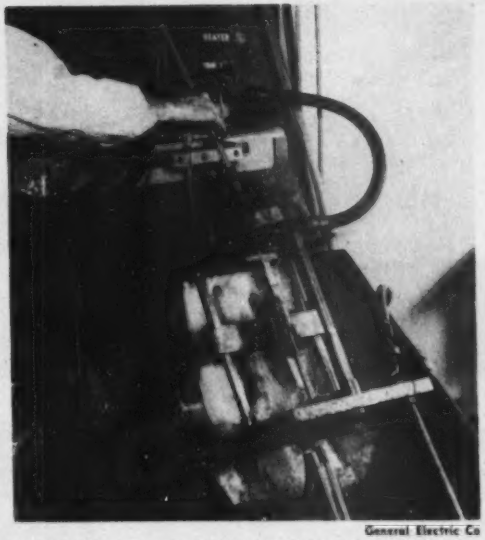
A 48% reduction in the cost of hardening basket shafts for use in washing machines has resulted through the use of two 15-kw electronic induction heaters at the Syracuse, N. Y., plant of the Easy Washing Machine Co.

According to Victor Barden, general foreman of Easy's heat-treat department, the entire cost of the hardening process, including labor, power costs, repairs, depreciation, and overhead, has been reduced from 13 to 6¾ ¢ per basket shaft.

Before adopting the induction heater method, the firm hardened the shafts with a cyanide process. In addition to the cost of the chemicals, this process took three shifts of two men to harden 1600 shafts. Now, with the heater, one man is able to accomplish the same thing in one 8-hr shift. This has allowed the company to transfer five valuable men to other, more productive posts.

The company also reports better hardness characteristics than were generally achieved under the old process. The equipment allows exact and automatically controlled heating and quenching times resulting in a uniform hardness, said Mr. Barden.

Similar savings have been realized in the manufacture of worm shafts, agitator shafts, and several other components where the induction heaters are being used. The heaters also supply selective heating for soldering, brazing, and annealing in the firm's highly-developed heat-treating department. The induction coil, not visible in the picture, is inside of the quench ring into which the operator is shown inserting a shaft.



General Electric Co

HARDENING washing machine basket shafts with two 15-kw electronic induction heaters reduces hardening costs 48% from previously-used chemical hardening methods

INDUSTRIAL BRIEFS

Glue drying of small "whatnot" tables has been speeded by an .8-kw dielectric heater at Hasse Mfg Co, Harrisburg, Pa. Drying time has been reduced from 4 hr to 20 sec—saving valuable floor space, increasing production and practically eliminating rejects. Wood strips and fiber boards are glued and placed in template before insertion into dielectric field. 20 sec is required to completely cure bond between two materials. J. V. Ford, Industrial Representative, Pennsylvania Power & Light Co, Harrisburg, Pennsylvania.

Melting paraffin with electric strip heaters at the Canton Corrugated Box Co, Canton, O., complete eliminates fires. Temperatures and paraffin thickness are more accurately controlled. A superior product results. In making paraffin coated corrugated paper packing cartons, paraffin is applied to the paper at approximately 243 F. Formerly melted by gas in a cast iron melting and roll application tank, fires were not unusual. 22 kw of thermostatically-controlled strip heaters were applied to the bottom of the tank. G. W. Craiglow, Ind Power Eng., Ohio Power Co, Canton, O.

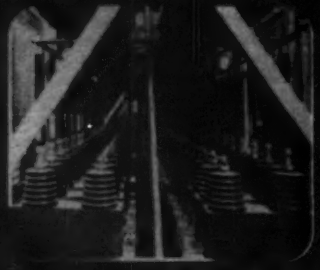
Materials handling with motor-operated conveyors at Continental Can Co, Mifflin Borough, Pa., keeps human handling to a minimum and effects substantial savings in production costs. One million cans are moved daily at high speed by conveyors which criss-cross entire plant. K. P. Allen, Industrial Power Engineer, Duquesne Light Co, Pittsburgh, Pa.

Capacitor installation of nine 7½-kvar, 3-phase banks enabled "Dolly Madison" Division of Interstate Bakeries Inc, Cincinnati, Ohio, not only to avoid numerous power failures but also to add three 15-ton air conditioning units to their already heavily loaded circuits prior to the installation of a larger switchboard which could not be delivered before hot weather set in. Air conditioning improved quality of product and comfort of employees. T. V. Morrow, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio.

Unit substations located on balconies save valuable floor space at Continental Can Co, Mifflin Borough, Pa. Voltage is reduced from 4000 to 440 v for power and 115/230 v for lighting. Efficient and flexible power distribution is assured by bus duct which is the principal means of power distribution throughout plant. K. P. Allen, Industrial Power Engineer, Duquesne Light Co, Pittsburgh, Pa.

Drying pharmaceuticals in electric oven at the Wm. S. Merrell Co, Cincinnati, Ohio, speeds up heating process and permits holding pharmaceuticals to close limits to prevent overheating and spoilage. Electric heaters eliminate possibility of water damage to valuable drugs possible when hot water heat is used. Vacuum-type oven has 9 kw in electric strip heaters rated 187.5 w each, and connected on 220-v, 3-phase service. Thermostat holds temperature within close range. Steam jet ejector maintains 29.9 in. vacuum. Because of high vacuum, heat transfer rate from hot water shelves is low and heating of material would be slow. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

1939



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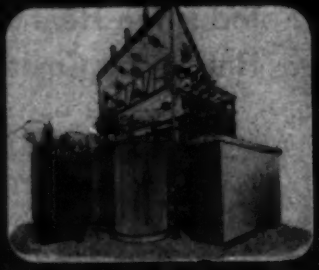

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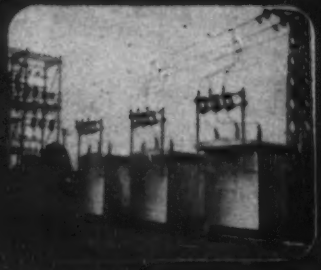

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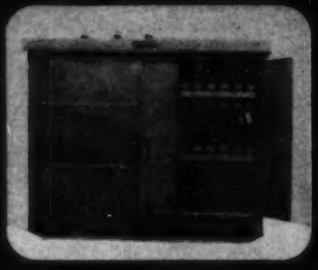

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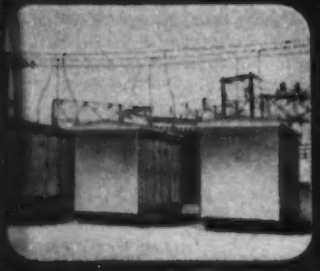

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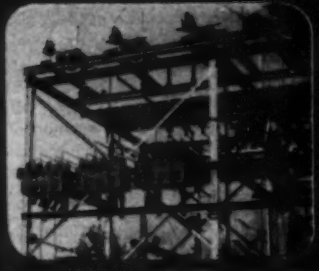

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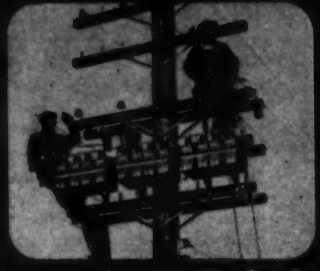

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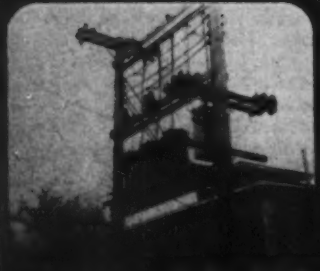

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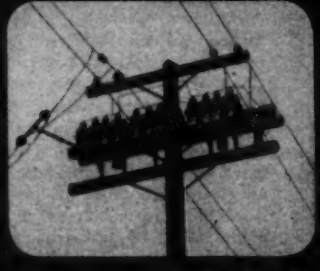

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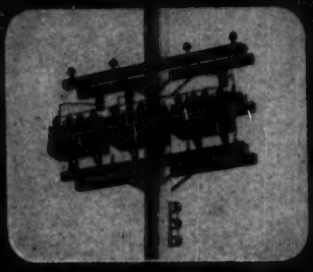

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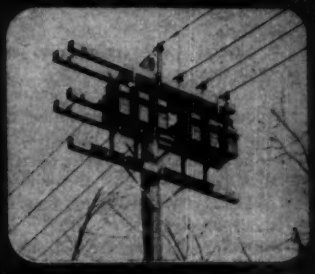

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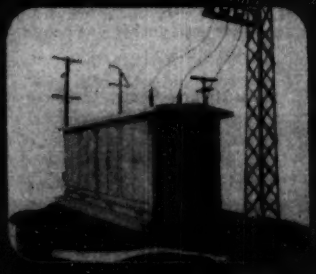


1946

the Years write an impressive testimonial to Cornell-Dubilier Capacitors

You will find them in the stations and on the poles of the country's largest power producers: C-D capacitors that have been in continuous operation since 1938, 1939, 1940 with *little or no maintenance required!* Over 4,000 time-tested C-D installations confirm that this is truly the most *consistently dependable* capacitor for power-factor improvement.

C-D gives you these extra safety factors

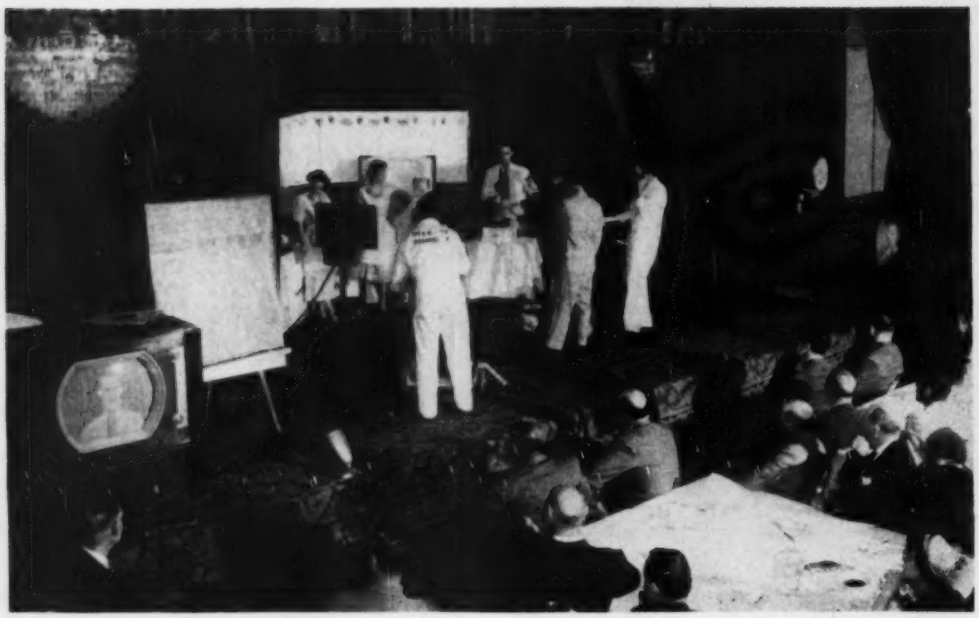
- C-D capacitors are designed to withstand transient over-voltages as well as steady state voltages. Low dielectric unit stress provides this extra margin of safety.
- Heavy major insulation in the form of laminated liners with reinforced corners, insures highest impulse withstand levels.
- Only C-D capacitors (from 230 to 13,800 volts), are subjected to a full rated voltage energization test.
- Wide margin between paper and foil provides higher insulation level.
- Use of C-D's Dykanol results in lower unit weight per KVAR; high stability; long life.
- Heavy-Duty wet process porcelain bushings for longer creepage path, less breakage, higher impulse rating.

Planning an installation of industrial, station or pole-type capacitors for power-factor improvement? You can save maintenance dollars and insure trouble-free service by talking it over with a C-D engineer. Cornell-Dubilier Electric Corp., Dept. D-12-B, South Plainfield, N. J.

CONSISTENTLY DEPENDABLE

CORNELL DUBILIER CAPACITORS

PLANTS IN SOUTH PLAINFIELD, N. J., NEW BEDFORD, WORCESTER, AND CAMBRIDGE, MASS., PROVIDENCE, R. I., INDIANAPOLIS, IND., FUQUAY SPRINGS, N. C., AND SUBSIDIARY, THE RADIART CORP., CLEVELAND, OHIO



TELEVISION SHOW produced by Dallas P&L's home service girls is shown to dealers, who later encourage range prospects to see it

Out-Selling Gas on the Range

Five-year electric range promotion by Dallas P&L running ahead of schedule. Aim is for 10% of saturation

It has taken a lot of doing, but the Dallas Power & Light Co has proved that electric ranges can be sold in the heart of natural gas country. They have done so by a stepped-up promotion campaign capitalizing on postwar indications that housewives were interested in the plus values of electric cooking.

Ranges in service have risen from less than 800 on the lines prior to the war—a saturation of less than 1%—to nearly 10,000, a saturation of more than 6%. The company hopes to increase saturation to 10% through a five-year selling program, launched late in 1949. This is based on area growth of 160,000 residential customers, which means an objective of 16,000 ranges on the system. The drive is progressing ahead of schedule. In two years range sales have exceeded 2,500 per year (see table).

In the process, DP&L has overcome several stumbling blocks. Although electric rates were low enough to prevent operating costs from being a problem, installation costs appeared to be a danger in the early going.

However, working with electricians, the company developed a plan for range installations at minimum cost and disturbance to existing wiring. This provides for a range switch below the meter base and a tap off for the other load.

As a further sales booster, electricians agreed to go along on a flat installation cost for wiring. This permits dealers to quote a complete delivered and installed price.

Convince Salesmen . . . Changing the thinking habits of salesmen was the next hurdle. They couldn't become accoustomed to the idea of selling electric ranges in a natural gas territory.

Several steps were taken to change their minds.

1. A bonus of $5 in addition to commissions was offered, the utility and the dealer each paying half.

2. Special prices were offered by manufacturers and distributors to salesmen buying electric ranges for their own homes.

3. Special cooking schools for salesmen were conducted by Dallas Power & Light's home service girls. The company has a standing offer to dealers: Home service girls will cook a dinner and show the salesmen the operation anytime the dealer will send his salesmen to the company's home service kitchen.

Kept Rolling Along . . . These moves did much to sell salesmen on selling electric ranges, but a number of other activities have helped to keep the ball rolling. When the program was launched, it was announced at a meeting of 200 range dealers. The plan called for an intensive four-month promotion, and a five-year program aiming at sales of 13,500. Promo-

NOW...THERE'S AN O-B CLAMPTOP

- for any voltage 22 to 69 kv
- for conductor ¼ inch to 1½ inch
- for pintype or line post

Now you can have the modern successor to the tie wire—the O-B Clamptop—for any voltage from 22 to 69 kv, and any size conductor cable from 0.25 to 1.50-inch, either in the conventional pintype design or the line post. Voltage, conductor diameter, or insulator style, are all now fully accommodated in the Clamptop category.

With Clamptops, loose connections at the insulator head, slipping conductors and strand chafing are ended. A man without special skill, using a common hand wrench, can make up the "tie" in considerably less than a minute, and make it better, stronger, and more lasting than the best-installed long-wire hand tie. If lines must be worked with hot tools, the Clamptop is outstanding in its simplicity, speed of handling, and much greater safety.

If you feel that the established pintype insulator design--regular or post--can't be improved upon, you haven't investigated the Clamptop. It's simple to handle, saves valuable time, and produces a better job at each point of support--and it is now available for free choice in the complete 22-69-kv range. By substituting a secure clamped connection for an insecure tie wire, you gain a long list of practical advantages. Specify O-B Clamptops on your next line project and see for yourself.

Ohio Brass

MANSFIELD OHIO, U.S.A.

4231-H

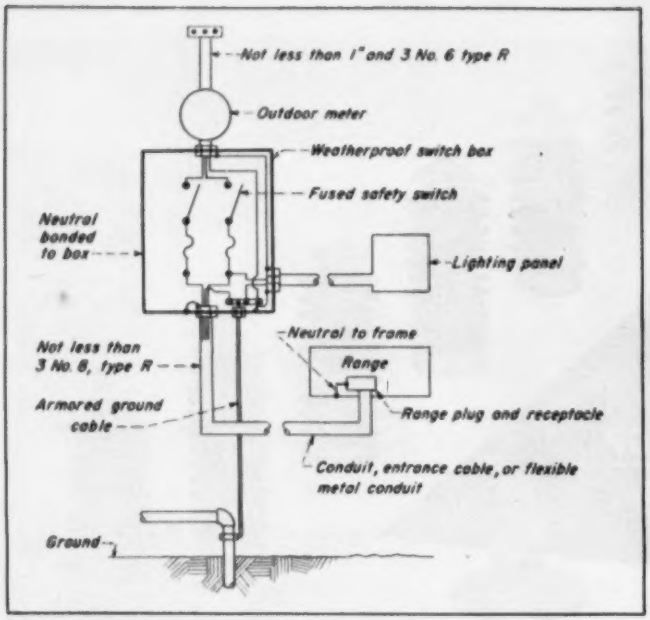


DIAGRAM of simplified range installation with existing load tapped from box installed below meter base. Result is minimum disturbance to existing wiring and low cost

Range Sales in Dallas Power & Light Service Area

	1948		1949		1950		1951		1952	
	Sales	Accum. Totals	Sales	Accum. Totals	Sales	Accum. Totals	Sales	Accum. Totals	Sales	Accum. Totals
Jan.	43	2044	52	2881	109	3910	177	6541	113	9116
Feb.	37	2081	22	2903	145	4055	189	6730	224	9340
Mar.	56	2137	47	2950	201	4256	206	6936	189	9529
Apr.	64	2201	76	3026	161	4417	354	7290	149	9678
May	61	2262	47	3073	226	4643	240	7530	171	9849
June	42	2304	23	3096	239	4882	172	7702		
July	49	2353	96	3192	242	5124	298	8000		
Aug.	26	2379	57	3249	239	5363	238	8238		
Sept.	135	2514	83	3332	252	5615	261	8499		
Oct.	95	2609	106	3438	295	5910	121	8620		
Nov.	86	2695	145	3583	194	6104	223	8843		
Dec.	134	2829	218	3801	260	6364	158	9003		
Total	830		972		2,563		2,639			

tional activities scheduled included:

1. A weekly television show put on by the home service girls from the company's auditorium.
2. Newspaper and radio advertising, with the former featuring typical installations of ranges in Dallas homes.
3. Special electric cooking sections in Dallas daily papers.
4. Ads by dealers and distributors.
5. Cooking schools for dealers and salesmen.
6. Direct mail materials.

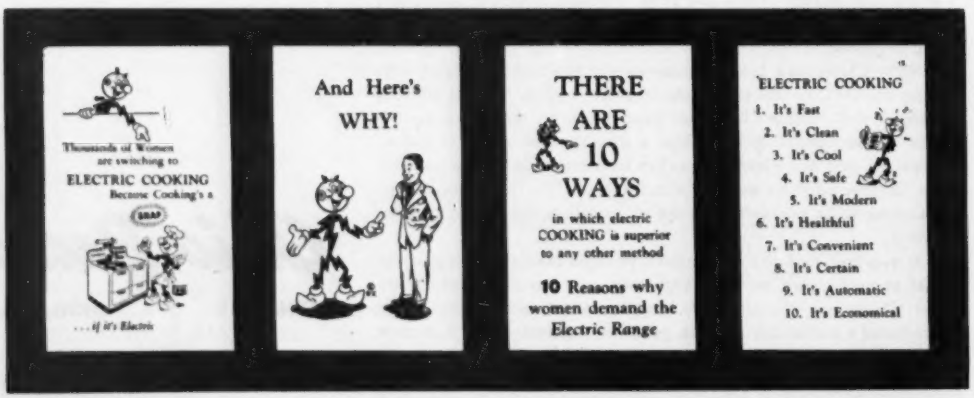
In January, 1950, a pep meeting to revive interest was attended by 500 salesmen. This was followed by another campaign of testimonial advertising, which has been one of the more effective tools throughout the program.

A skit emphasizing advantages of electric cooking highlighted a meeting two months later, and launched renewed activity in ranges and home freezers.

An eight-page booklet outlined the program for dealers and salesmen. Samples of direct mail pieces were distributed and salesmen were told all promotional activities that had been launched in the fall of 1949 would be continued.

Meetings to revive interest were held in April and June 1950, in May and September, 1951 and in May of this year. Last November the TV promotion was increased to two programs a week.

Plans call for continuation of the program along lines followed to date, with changes planned from time to time to renew interest and to take advantage of experience gained.



TYPICAL SELECTION from among 18 cards used by salesmen to promote electric range sales among potential customers. Remainder of cards, through humorous line drawing of Reddy Kilowatt, illustrate the ten reasons for buying a range, listed at right

IMPROVED THERMAL RESISTANCE WITH

VICTOR PURIFIED PORCELAIN

TRANSMISSION PINTYPES!

VICTOR NO. 245 TRANSMISSION PINTYPE

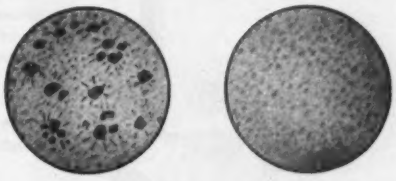
For complete engineering data on this insulator and other sizes and types, send today for Bulletin No. 4.

More Uniform Thermal Expansion Achieved

VICTOR *Purified* Porcelain has the most uniform thermal expansion ever achieved in the insulator field—expansion that remains uniform throughout its entire mass. This achievement, like *Purified* Porcelain's many other advantages, is due to the removal of all mineral salts from the water used in processing.

With VICTOR *Purified* Porcelain, failure of shells due to sudden thermal changes is eliminated. Choose VICTOR TRANSMISSION PINTYPES—made of *Purified* Porcelain—finest insulator porcelain ever made!

VICTOR INSULATORS, INC. VICTOR, N. Y.



Cross-Section of Ordinary Porcelain

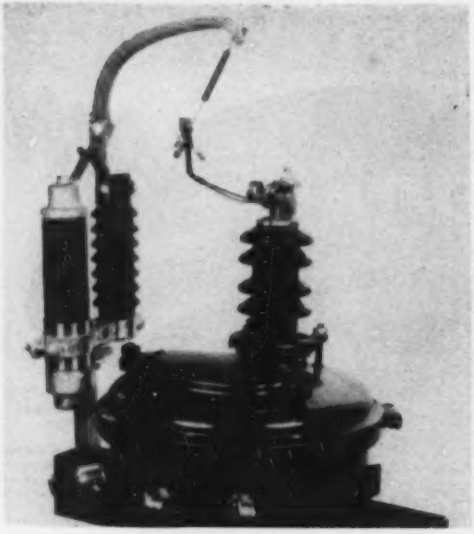
Cross-Section of *Purified* Porcelain

Here's Why *Purified* Porcelain Has Uniform Expansion

The drawing at the left shows a greatly enlarged section of ordinary porcelain and reveals what ceramic authorities agree contributes to porcelain weakness and possible failure under unusual service conditions. The various irregular shapes are glass-like impurities which are formed during firing, by mineral salts in the processing water. After firing, these impurities shrink at a different rate than does the porcelain itself, causing tiny fissures (shown by the dark radiating lines) which physically weaken the insulator and make it more vulnerable to puncture. Also, these differing rates of thermal expansion set up dangerous strains and stresses during sudden temperature changes in service that can actually weaken the insulator.

The drawing at the right shows the homogeneous quality of *Purified* Porcelain. Its absence of impurities gives uniform thermal expansion and lessens the possibility of failure under extreme conditions. Other advantages: maximum density and hardness, higher mechanical impact values, improved range of M and E strength values and higher oil puncture values!

NEW EQUIPMENT



Lightning Arrester

For mounting on conventional 3-25 kva rural transformer, this lightning arrester-cutout combination is adaptable to left- or right-hand positioning with respect to secondary conductors. Arrester and upper contact arm are mounted on the unused mounting lug of the transformer, lower contact arm is mounted on the line terminal of the cover bushing.

Unit can be shipped mounted on the transformer, by folding upper contact arm down. For lightning protection of transformers with internal fuses, the arrester may be obtained separately. The combination has protective characteristics said to be comparable to individual units.
General Electric Co, Schenectady 5, N. Y.

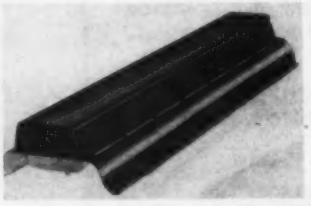
Radiation Detector

The Radector, a new radiation detector which utilizes the Neher-White ionization chamber, is reported capable of measuring from ordinary background radiation to over 1500 Roentgens per hour, on a single scale.

The instrument does not depend on amplification and therefore requires no rectifiers, condensers or transformers. Measuring 5x3x3 in, the Radector weighs 2 lb and is powered by 4½ v. Battery life is said to nearly equal shelf life.
Jordan Electronic Mfg Co, 9042 Culver Blvd, Culver City, Calif.

Handy-Talkie

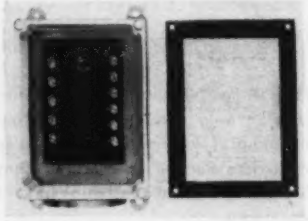
Weighing only 6½ lb, with batteries, this radio transmitter-receiver is designed for emergency conditions. As the AN/PRC-6 it is at present in production limited to the Signal Corps. Industrial uses are forecast. Carried slung over shoulder, the cast-magnesium housing contains the transmitter, receiver, batteries (3½ lb). Effective range 1-3 mi, depending on terrain.
Emerson Radio and Phonograph Corp, 111 Eighth Ave, New York 11, N. Y.



Diffuser Unit

This indirect lighting component is designed to modify the contrast between brightly lighted work areas and dark upper areas. The all-steel fixture is available with open or closed ends, for two or three 40-w lamps.

Reflector is finished in high gloss black or porcelain enamel. Unit may be ceiling mounted or suspended, singly or in rows.
Leader Electric Co, 3500 N. Kedzie Ave, Chicago 18, Ill.



Liquid Level Control

A device for measuring the level of electrically conductive liquids, this control requires no moving parts within the tank. Stainless steel probe rods, together with the liquid between the rods, form a circuit whose resistivity is a measure of the liquid level.

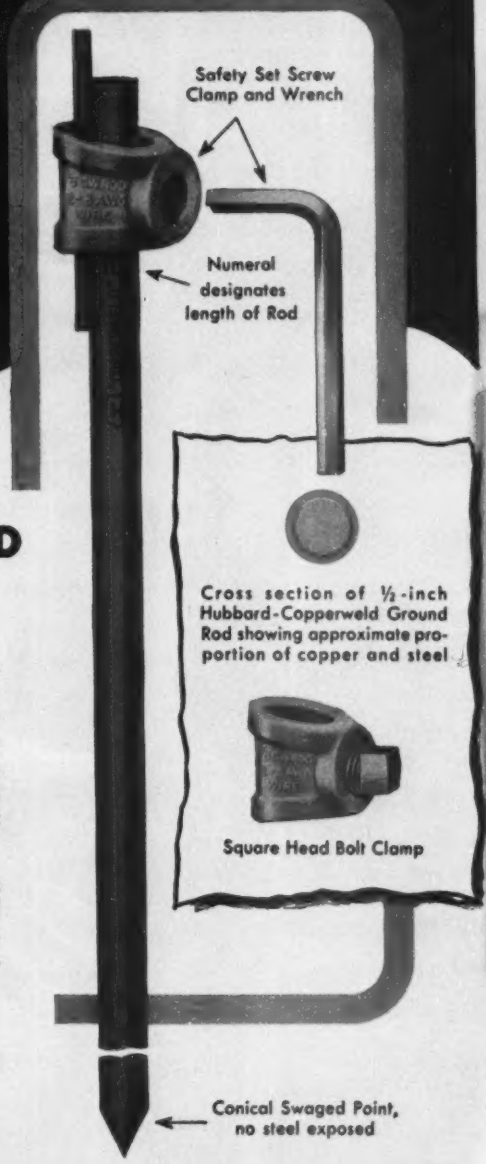
The device is said to distinguish between the actual liquid level and any foam that may be present, or saturated vapor in the tank. Further information in Bulletin PF479, available from the company.
Photoswitch Inc, 77 Broadway, Cambridge, Mass.

Demand Switch

An automatic demand control switch, rated at 250v 60 amp, has a controlling load of 27 amp and a de-

(*Continued on page* 133)

HOW LONG DO YOUR GROUND RODS LAST?


Safety Set Screw Clamp and Wrench
Numeral designates length of Rod
Cross section of ½-inch Hubbard-Copperweld Ground Rod showing approximate proportion of copper and steel
Square Head Bolt Clamp
Conical Swaged Point, no steel exposed

If They're HUBBARD-COPPERWELD You Know the Answer

The time-tested dependability and economy of Hubbard-Copperweld products have been proven in service for 36 years. The permanent Molten-Weld completely eliminates the possibility of harmful electro-galvanic action within the rod. There are no microscopic cracks, fissures, or pin holes in the thick copper exterior to admit moisture and give destructive rust a foothold.

For permanent grounding protection at lowest annual cost, insist upon Hubbard-Copperweld Ground Rods, with the rust resistance and conductance of copper plus the strength and easy-driving qualities of alloy steel.

Hubbard-Copperweld Ground Rods, R. E. A. item "TD-ai," and Ground Rod Clamps, R. E. A. item "TD-aj," are manufactured in all R. E. A. standard sizes.

HUBBARD AND COMPANY
ESTABLISHED 1843
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA
"Hang the Load on Hubbard Hardware!"

Facts from
TENNESSEE

"'CSP®' Transformer saves $125 per year in service calls"

"25 service trips for re-fusing during each lightning season, at a cost of about $5.00 per trip, was the price we had been paying to keep a single conventional transformer in service," reports a Tennessee Utility. "The transformer was located in a particularly severe lightning area, and we had come to accept the outages as somewhat pardonable. One day it was necessary to make three trips to restore service.

"About 10 years ago we replaced it with a 'CSP' transformer which has been in continuous service ever since. Its record of performance, paying for itself within the first year, has resulted in our adoption of 'CSP' transformers for all rural construction."

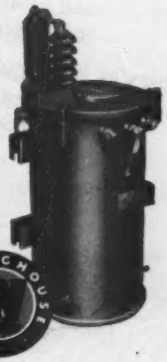
Installation and maintenance costs for Westinghouse "CSP" (Completely Self-Protecting) Transformers are always lower, because complete protective equipment is built in, not separately mounted. A two-year survey of Electric Light and Power Companies shows the following:

NATIONAL AVERAGES

	"CSP"	Conventional
Installation Costs	$13.87	$24.74
Burn-out Rate	0.257%	1.005%
Fuse Outages	None	5.64% @ $6.52 per outage
Load Checks	Automatic	12.8%
Breaker Reset	1.02%	None

If you'd like to check your own costs against these national averages, ask your Westinghouse representative for Booklet 4247-B, "Transformer Costs and Their Relation to Profits". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

"CSP" devices . . . originated and patented by Westinghouse



YOU CAN BE SURE... IF IT'S
Westinghouse
"CSP" DISTRIBUTION TRANSFORMERS

J-70593

You Get This Same "One-Piece" Jaw in ALL FARGO AUTOMATIC LINE SPLICES

The "ALS" Series for ALL ALUMINUM

The "LS" Series for COPPER

THEY'RE EASILY and QUICKLY INSTALLED . . . Fully automatic.

THEY'RE SAFE . . . No tools required.

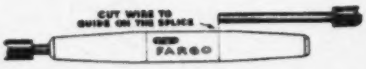
THEY'RE PERMANENT . . . Greater strength and holding power with the exclusive "one-piece" jaw.

THEY'RE ECONOMICAL . . . Time and labor saved on both new construction and maintenance.

"ONE-PIECE" JAW CONSTRUCTION

Precision machining of the "one-piece" jaw from solid stock assures permanent alignment of the 4 jaw segments for strength, holding power and ease of installation.

"Sag Guide" Marks Save Time



"Sag Guide" lines on each Fargo Splice show how much of the conductor should go inside.

Ask your Line Material Field Engineer to give you complete details.

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

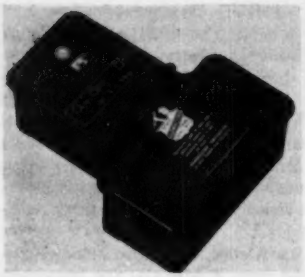
Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

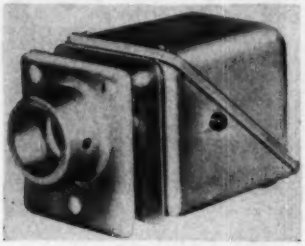
Milwaukee, Wisconsin



ferred load circuit of 18 amp.

Designed to defer heater circuits at prior peak loads, the unit is mounted in a bakelite case, ambient temperature compensated and thermally controlled.

Kilowatticher Corp, 141 West Jackson Blvd, Chicago 4, Ill.



Flame Failure Safeguard

A phototube and amplifying photoelectric flame failure safeguard operates on 115/208/230v, 50/60 cps, at 10w. The ambient temperature limit is 150 F and the sensitivity 15 ft. c.

The safeguard may be used for flame protection with manually lighted oil burner, heaters, ovens, kilns, etc. Flame failure is registered by a pilot light.

Combustion Control Corp, Cambridge, Mass.

Gearmotors

Combining motor and speed reducer in a single housing, the gear-

● Far too many poles are ready for the scrap pile long before they've been in service for 30 years. However, if your poles are pressure-treated with creosote, you *know* they are capable of 30 or more years of dependable service—countless service records prove it.

That's why it's smart to treat your poles with creosote. Creosote is a mixture of a number of compounds which are toxic to insects and fungi, the two principal causes of deterioration in wood poles.

Creosote has another important advantage: it's been in use now for more than 100 years, and experienced technicians can treat poles to obtain deepest penetration and maximum retention. They know, too, how to apply creosote and leave poles dry, so that you will not get complaints about their cleanliness.

Specify Koppers Creosote. Koppers, one of the nation's largest producers of creosote, assures you highest quality and service.

For more information about the advantages of creosote for your wood preserving, contact Koppers Company, Inc., Tar Products Division, Pittsburgh 19, Pa.

KOPPERS COMPANY, INC., PITTSBURGH 19, PA.

Tar Products Division

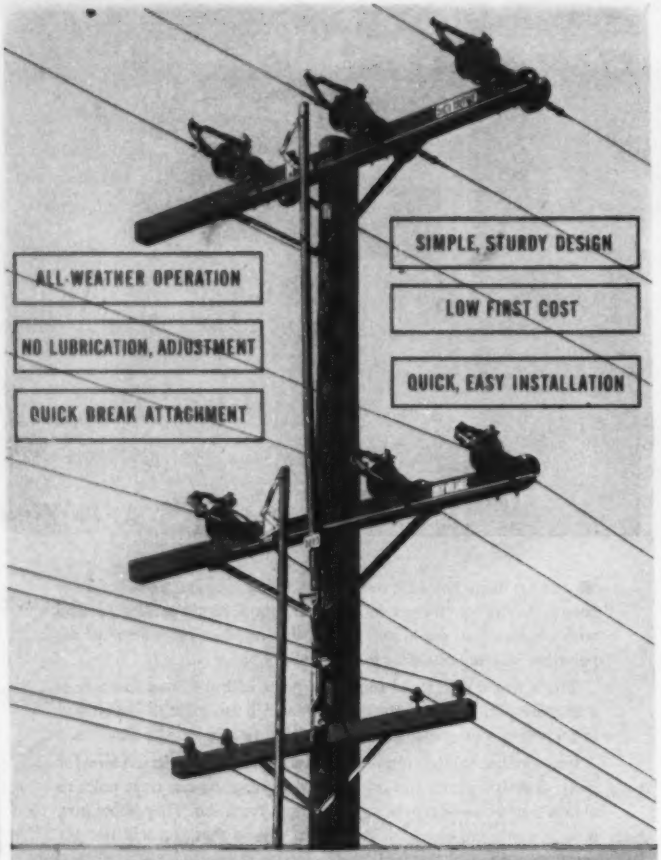
KOPPERS

All Standard Specifications

Creosote

The Performance-Proved Wood Preservative

KPF POLE TOP SWITCHES



MORE SWITCH FOR LESS MONEY

KPF Pole Top Switches cost less to buy and give longer service because they are simplest in design, sturdily built. They need no separate deadends, no "extra" insulators. Simple "3-step" installation saves man hours—(just bore holes in cross-arms, tighten bolts, attach connectors). Insulator stacks easily adjusted for line sag. Free-floating, self-aligning, silver-surfaced blades always maintain proper contact. Vertical, horizontal or triangular mounting. Write today for Catalog, details of KPF switches.

3904

KPF ELECTRIC COMPANY
1624 E. Alpine Avenue • Stockton 5, Calif.

motors provide speed ratios from 2.5:1 to 97:1. The speed reducers include planetary, offset and right-angle worm-wheel type.

The motors are available in ratings from ½ to 15 hp, in ac squirrel series cage, wound rotor, and dc shunt, series and compound types. Further information is contained in bulletin B-601, obtainable on request from the company.

Star-Kimble Motor Div, Miehle Printing Press & Mfg Co, 200 Bloomfield Ave, Bloomfield, N. J.

Contact-Making dc Instrument

Model 1087 is a switchboard instrument, of core magnet mechanism type, with two adjustable stationary contacts and a contact carried on the pointer. The low and high stationary contacts "make" or "break" under direct influence of the current in the instrument's moving coil.

The contact circuit is electrically insulated from the moving coil circuit. Contact rating is 6v 0.030 amp dc non-inductive, maximum. The instrument may be used for control of voltage or current levels of standby batteries, in electro-plating processes, for indication and control of speed, etc.

Weston Electric Instrument Co, 617 Frelinghuysen Ave, Newark 5, N. J.

Charge Indicator

For use with industrial truck batteries, the instrument can be mounted so the operator sees the state of bat-

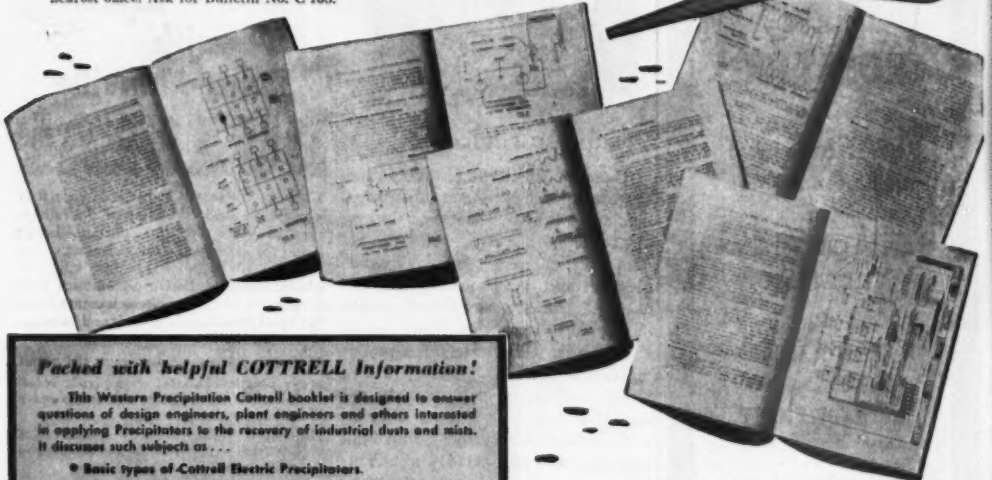
FREE

From Western Precipitation–the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this booklet on the COTTRELL Electrical Precipitator helpful and informative.

Western Precipitation pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 42 years Western Precipitation has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.



Packed with helpful COTTRELL Information!

This Western Precipitation Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

- Basic types of Cottrell Electric Precipitators.
- Principal parts of a Cottrell Precipitator.
- Mechanical and Electronic Rectifiers.
- Various types of Collecting Electrodes (rod curtains, corrugated plates, dual plates, pocket electrodes, etc.).
- Removal of Collected Material.
- Factors in Shell Construction (steel, concrete, brick, etc.).
- Operating Efficiencies and the Effect of Various Factors on Performance.

...and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

Western Precipitation is not affiliated with any other company in the field of electrical precipitation except its wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. Whether you are now contemplating the installation of a Cottrell Electrical Precipitator, or may be interested in such an installation at a future date, we can and will serve you in any part of the United States or other countries.

NOW SELLING

COTTRELL Precipitators
MULTICLONE Collectors
TURBULAIRE Spray Dryers

...in all parts of the U. S. A. and foreign countries.

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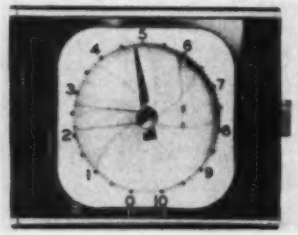
tery charge while the truck is operating. Three-colored dial indicates whether the battery is "full," "½," "empty" or in "danger."

The Wheatstone bridge type instrument is adjustable for 3, 6, 12, 15, 18 and 24-cell batteries, by means of resistors and taps. Mounted in a black enamel metal case, the instrument is balanced to read accurately regardless of position. A toggle switch disconnects the indicator during charge.
Gould-National Batteries Inc, Trenton 7, N. J.



Round-chart Recorder

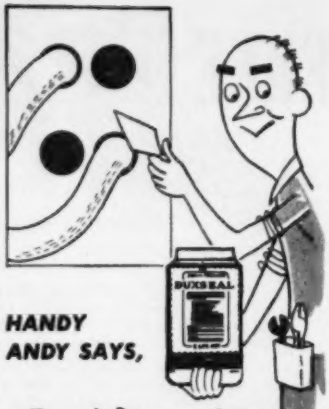
These round-chart recorders and automatic controllers are high-speed continuous-balance electronic instruments, of the null-type, which can be used to measure and record any variable that can be converted into an electrical quantity. Used with smoke density detectors, tachometer magnetos, thermal converters for power measurement, etc.

The variable is simultaneously recorded and indicated on a circular scale. Models are available with full-scale pen travel of ⅗ to 7 sec. The instrument is housed in a moisture-proof case for wall or panel mounting.
Bristol Co, Waterbury 20, Conn.

Circuit Breaker

Designed for 3 and 2-wire lighting protection, the K-173 is a plug-in circuit breaker rated at 125v ac or dc, with trip ratings from 10 to 50 amp for any frequency system between 60 and 400 cps; interrupting rating is 5,000 amp.

The breaker is mounted in special sub-base and is suitable for overload and short-circuit protection. A dam-



HANDY ANDY SAYS,

Seal it Quick
...seal it Tight
with
Johns-Manville
DUXSEAL

KEEP A PACKAGE of Duxseal in your tool box for on-the-spot sealing of duct openings, potheads, bushings, terminal boxes—and for filling multi-wire contact boxes indoors. It's a nonhardening adhesive plastic compound with an asbestos base . . . goes on like putty just as it comes from the handy package . . . provides a smooth, workmanlike job.

Check these 4 important advantages of Duxseal:

Stays plastic—Duxseal stays plastic indefinitely. Will not slump, melt or run under ordinary temperatures.

Stays tight—Clings to duct walls and cables but flexes with expansion and contraction of the cable.

Stays insoluble—Unaffected by ground waters and gases.

Stays harmless—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

Tight seals for other electrical uses:

J-M Tranolseal . . . for use against refined oils employed in transformers, switches and similar equipment.

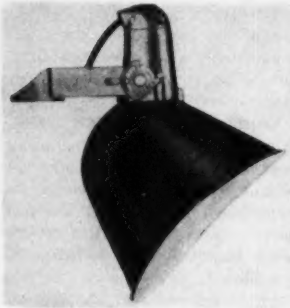
J-M Uniseal . . . for caulking equipment outdoors or in fume-laden areas. Resists temperatures up to 180° F.

Let us send you more information about Duxseal and other J-M labor-saving sealing compounds. Just write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto, Ontario.

JM

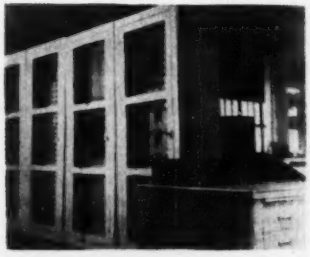
Johns-Manville
SEALING COMPOUNDS

aged breaker can be replaced without disconnecting a line or load wire. Further information is available in Bulletin TEE-6.
Trumbull Electric Dept, General Electric Co, 41 Woodford Ave, Plainville, Conn.



Elliptical Floodlight

Available for lamps from 300-1500w type PS, 750-1000w type T-24 and 400w mercury vapor type T-16, the Spaceliter elliptical floodlight has a reflector finished inside and out with vitreous-fixed porcelain enamel. Adaptable to outdoor space lighting, the brackets may be attached to wall, crossarm, pipe or pole top. An indicator scale with 5-deg gradations is provided for aiming.
Steber Mfg Co, Broadview, Ill.



Sequential Recorder and Annunciator

An automatic data recording and annunciating system for electric power plants is reported capable of "storing up" and printing a sequential recording of a series of abnormal conditions. As many as 400 different "con-

CONVENIENCE IN OPERATION—
A 60-watt transmitter, receiver, power supply, and controls—in a single unit for desk-top operation. Available in 30-50 mc range, 152-174 mc range.

CONVENIENCE IN MAINTENANCE—
Chassis slides up for complete accessibility. Cabinet acts as handy, solid servicing rack. No need to remove chassis from cabinet.

NOW see what CONVENIENCE means with RCA's new 2-way radio station

CONVENIENT!
Compact, space-saving design
Complete base station in a single desk-top unit using less than 3½ square feet of desk space—saves valuable floor space.

CONVENIENT!
Up to 3 transmitter channels, 2 receiver channels
Designed for up to 3-channel transmission and 2-channel reception where required. Lights on front panel indicate frequency in use.

CONVENIENT!
Easy to install and service
Just plug in transmission line and AC power and you are ready to operate. Lift-out chassis for servicing in cabinet. Metering plugs for easy checking.

CONVENIENT!
Local or remote operation
Choice of local or remote control base station in single, compact cabinet. Chassis also available in standard cabinet rack or weatherproof, pole-mounting box.

For further details on the new RCA 60-watt desk station, MAIL COUPON NOW

Dept. 45HE, RCA Engineering Products,
Camden, New Jersey
( ) Please send me information on new Carfone desk station.
Also send me information on 2-Way Radio for:
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( ) Transportation (Trucks, Buses, Taxis) ( ) Public Safety (Police, Fire, Ranger)

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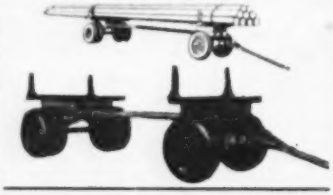
RCA **RADIO CORPORATION of AMERICA**
MOBILE COMMUNICATIONS CAMDEN, N. J.

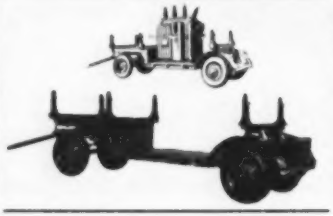
Notes on Eagle Equipment —
Designed to save man-hours and money

TRAILERS

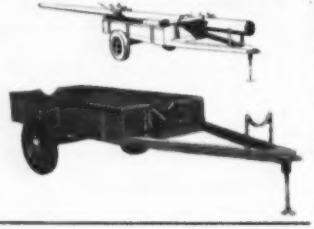
...IN A WIDE RANGE OF SIZES AND TYPES



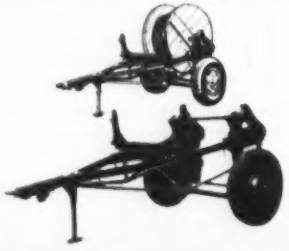
ADJUSTABLE LENGTH POLE TRAILER: easily adjusts to accommodate poles up to 90 ft. long — a big trailer that does a big job. Center pole telescopes. Trails smoothly. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6450.



FOUR-WHEEL LO-BED TRAILER: for easy loading and hauling of heavy bulky units, also suited to pole and general purpose hauling. Five ton capacity, overall length 25 ft. 8 inches. Distance ground to low platform only 25½ inches. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6441.



LIGHT-DUTY CARGO AND GENERAL PURPOSE TRAILER: light-duty, 1-ton capacity trailer for hauling one or two poles, cross-arms, pole hardware, etc. Has pole saddles front and rear and removable end boards. Get complete information on Eagle Trailer Model 7163.



COMBINATION CABLE REEL AND POLE TRAILER: complete with bolsters, stanchions, cable reel saddles. Quickly converted into a pole trailer by removing cable reel saddles and installing bolsters. A practical dual purpose unit, requiring only one trailer license. Get complete information on Eagle Trailer PCP — W-PCP series.

Send today for the complete catalog of Eagle Line Construction and Maintenance Equipment — a useful reference book.

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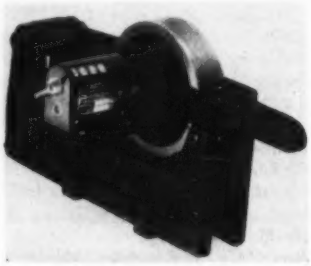
Division of The Four Wheel Drive Auto Co.

ditions" can be automatically reported, recorded and printed.
Taller & Cooper Inc, 75 Front St, Brooklyn, N. Y.

Cold Cathode Tube

A cold cathode triode for control of industrial electronic equipment is said to have unlimited life. The tube contains an external electrode, can operate under wide temperature conditions, eliminates warm-up time and stand-by currents.

Amplification to 2,500,000 possible, with grid current less 1 micro-amp. Input impedance up to 100 megohm. Tube Type TT-1. Applications are pilot relays, liquid level controls, counters, timers and similar devices.
Haledy Electronics Co, 57 William St, New York 5, N. Y.



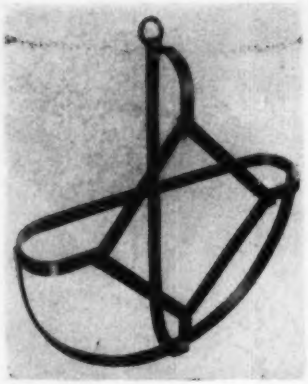
Measuring Machine

Used to measure length of wire, cable, cordage, strip steel, etc, the machine measures in feet and inches up to 400 fpm with standard counters. Special counters can be used to count to 2,000 fpm.

No. 1/0 machine measures ¾ in dia or 1 in wide; No. 1 machine 1¼ in dia or 1¾ in wide. The measuring wheel rides on the material, to eliminate errors from bends and twists in the material, and a brake stops the wheel when the material runs out.
Neal Co, P. O. Box 237, Omaha, Nebr.

Guy Wire Dispenser

This dispenser is designed to feed the guy wire smoothly, and is said to eliminate the whipping of guy strand ends. The wire is fed from the center



of the coil through a square opening which keeps the strand from uncoiling.

Wires can be unreeled from vertical or horizontal position such as suspended from truck or placed flat on ground. Used rolls may be stored on the dispenser which weighs 21 lb without the guy cord.

A. B. Chance, Centralia, Missouri.

Lead-Lag Ballast

This lead-lag slimline ballast is said to combine series economy and size with lead-lag performance and dependability. It is available in 38, 58 and 75-w two-lamp sizes. Size 3⅛ x 2⅝ x 13¾ in. Stroboscopic correction and long lamp life, 25% reduction in wattage losses are claimed.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

MORE NEW PRODUCTS

about which you should know

Sola Electric Co, 4633 West 16 St, Chicago 50, Ill, has a weatherproof **outdoor transformer** for use with 400-w, type EH-1 and JH-1 mercury vapor lamps. The transformer is the "constant wattage" type and is designed for operating a single lamp, and for primary voltages 100-130v or 200-260v. . . . Automatic Temperature Control Co Inc, 5200 Pulaski Ave, Philadelphia 44, Pa, announces a precision torsion bar **load cell** to change a mechanical force into an electrical signal. Operating through a differential transformer, movement of the torsion bar generates a signal fed to an indicator or recorder; ranges from 0-100 lb to 0-2500 lb.

Better public relations result

. . . when power plant noise is scientifically silenced by Industrial Sound Control.

Neighbors are grateful for relief from the roar of fans, or the disturbing hum of a substation transformer.

Employees welcome working conditions which put an end to the tension, fatigue, slowed reflexes — and needless accidents — caused by excessive noise.

ISC pioneered industrial noise suppression devices and methods . . . their experience, gained over the years, can help you. Write today for free booklet "Sound Facts".

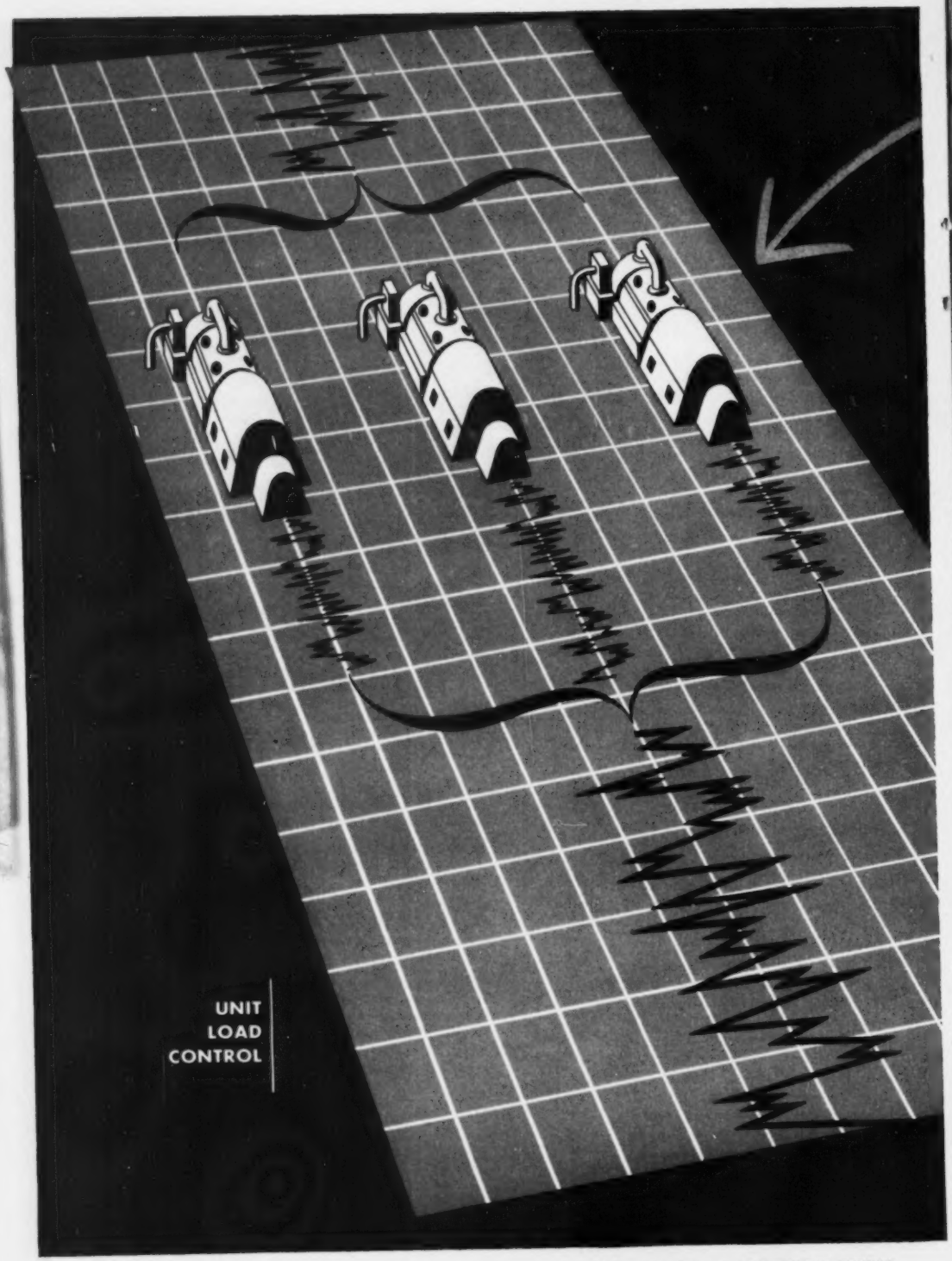
Midwestern distributor: Midwest Industrial Sound Control, Inc., 1455 North Pennsylvania Street, Indianapolis 2, Indiana.

SILENCE SERVICE

Industrial Sound Control Inc.

45 Granby Street, Hartford 12, Conn.

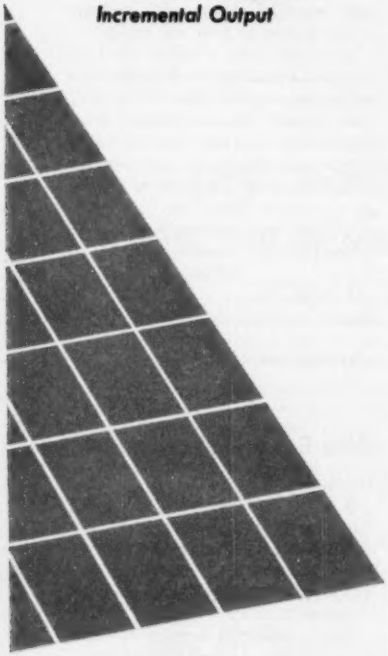
2119 SO. SEPULVEDA BLVD., LOS ANGELES, CALIF.


UNIT
LOAD
CONTROL

here's how

TO MAKE BIG LOAD CHANGES LOOK SMALL

- *Distribute Station Load Changes . . .*
- *Among Any Number of Operating Units . . .*
- *To Provide a Regulated Incremental Output*



• By splitting up the load-regulating burden, more and more generating stations are getting the kind of benefits shown in the diagram at the left. Efficient, automatic distribution, under L&N Unit Load Control, answers the problem of how to minimize the effects of swings.

Suppose the three 10,000 Kw units in the diagram are on the line, when a customer load swing of 10 per cent of the station output develops. At once the question arises of how to regulate the generators at this new load level . . . how many machines to use, and how to use them.

In plants where only one machine would handle the regulation, that machine would have to change its output very substantially, and thus decrease the unit's efficiency.

However, if all three generators share the swing, each gets only one-third of the change, and . . . efficiency curves being what they are . . . the decrease is sharply reduced. The station carries its load smoothly and economically.

L&N Unit Load Control makes such operation not only possible but routine and fully automatic. Short-time load swings are stretched so thin that loading of individual generators is practically unaffected by fringe variations.

Flexibility? Operators can load machines in practically any desired manner. Generators may be loaded equally; load may be divided in proportion to machine ratings; some units may hold base load while others regulate.

Reliability? L&N equipment now solves the vast majority of all utility load-frequency control problems.

Engineering? You are invited to send details of your station's load-control problem either to our nearest office, or to 4938 Stenton Avenue, Philadelphia 44, Pa.

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CONTROLS • INSTRUMENTS • FURNACES

Jrl. Ad ND4-56-461(9)

LETTERS TO THE EDITOR

Reddy Has Nose Trouble

To the Editor:

Your article "A Light Bulb Talks —" in the Aug. 11 issue of Electrical World sure has my nose out of joint.

It was a good story as far as it went, but gosh, Mister—you didn't tell the half of it!

I admit I'm no Clark Gable, but I'm very proud of that beezer of mine —why I've got a schnozzola that would even put Jimmy Durante to shame.

An interesting thing about it is that my nose is adaptable. It can be that the bulb that powers the huge searchlights or the tiny little grain of wheat lamp in the end of a surgical instrument.

Course what most companies do is promote household Bulb Kits in a variety of sizes for every working-reading need.

All kidding aside your editorial had a lot of meat in it, and Electrical World deserves a lot of credit for calling attention to the basic load of the industry.

Reddy Kilowatt

50 Church Street
New York 7, N. Y.

• Dear Reddy: We like you and your nose. Never in the world would we want to alter your countenance. Please screw your nasal appendage into place.

Cu-Al Connectors

To the Editor:

We were interested to read Mr C. E. Baugh's description, in your 2nd June number (p. 82), of tests made with aluminum-copper connections.

The area chosen for the tests is obviously very severe, but, nevertheless, trouble should not occur "after less than three years of service." We have similar tests taking place at Mombasa on a small low tension transmission line supplying domestic consumers within a hundred yards or so of the coast. There is no need to emphasize the hot, humid, and saline conditions in that area. The position is, that after two years, the report was completely satisfactory, and one fitting removed showed no signs of corrosion beyond, of course, the usual weathering. The internal aluminum-copper junction was in perfect condition.

Some five years have now elapsed, and behaviour of the fittings continues to be perfectly satisfactory. Two have been removed and are on their way to this country for detailed examination. The fittings in question were aluminum to copper tee tappings, but their design is quite different from those mentioned in Mr Baugh's tests. The copper-gripping brass portion is screwed hard home into the aluminum body so that the contact is good, but a gap is left between the two dissimilar metals and this is filled by some weather-resisting compound. The bi-metalic junction is thus kept dry, and 25 years experience has fully justified the use of this arrangement.

We were struck by the fact that amongst the conclusions reached as a result of the tests no mention is made of a very important point, viz metal purity. We have found that small percentages of copper and zinc can have quite serious results.

We see that P. G. Clamps with copper inserts and also bi-metallic washers were not satisfactory in Mr Baugh's tests. Neither of these arrangements is used in the U. K. to any extent.

In our view, since Mr Baugh's tests only cover certain designs of aluminum-copper fittings and do not include other designs which have proved their worth, the generalization that trouble may be expected in service with such fittings is hardly justified.

C. H. E. Ridpath
Chief Electrical Engineer
Aluminum Wire & Cable Co, Ltd
37 Thurloe Street
South Kensington
London, S. W. 7, England

• EW thanks Reader Ridpath for his worthwhile information on copper-aluminum connectors.

What Word Do You Use?

To the Editor:

Much confusion exists in accounting circles over certain uses of the word "overhead." Even after it has been carefully defined, there remain questions of interpretation in particular applications of the term.

For the electric utility industry, the Federal Power Commission has classified all construction costs as being either "direct" or "overhead." Therefore, if it is said that "overhead is running 10% of direct construction costs," the statement should mean the same thing to everyone in the industry.

Unfortunately there are certain border-line costs, such as those associated with construction facilities, for which no official title exists. Some people have chosen the word "indirect" to describe these costs. This choice seems to me most unfortunate because it might be inferred that, inasmuch as these costs are not "direct," they must be "overhead." Nothing could be further from the truth!

I believe that a better word to describe construction facilities et cetera is "burden." What other words have your readers found to denote these construction costs that are temporarily lodged in clearing or suspense accounts, but must eventually be distributed as either "direct" or "overhead" to satisfy the requirements of the Federal Power Commission?

William H. Hamilton

135 Dahlia St.
Denver 20, Colorado

• Readers, speak up!

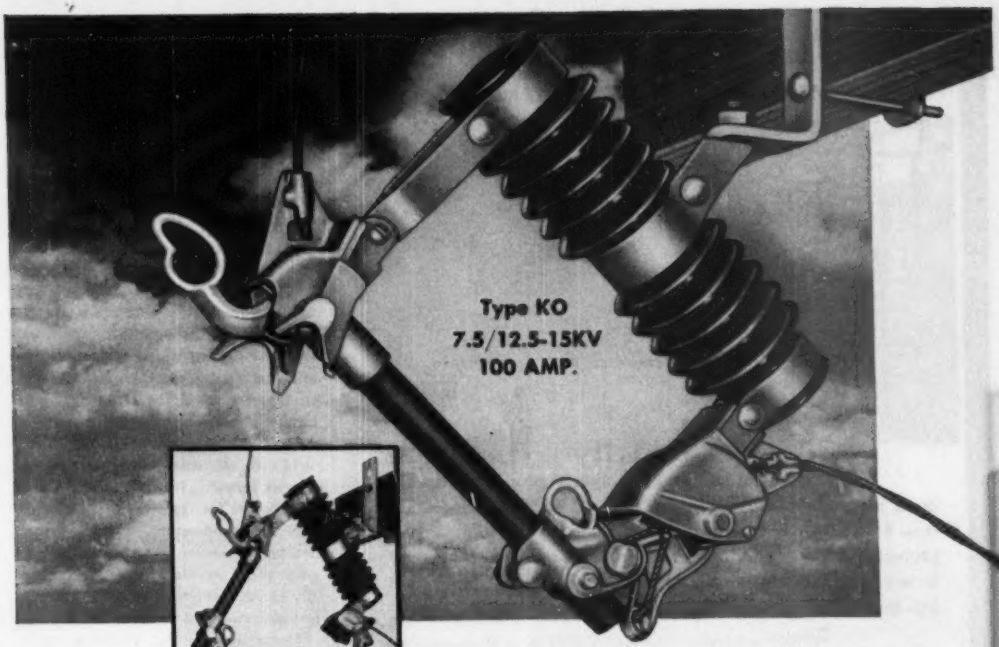
Ohio Power Takes Credit

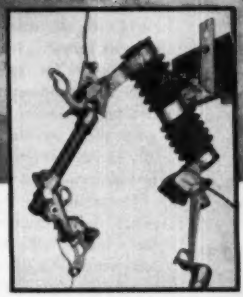
To the Editor:

It has been called to my attention that in your Aug. 4 issue, p 34, the third "Power Brief" states that Dayton Power & Light Co has been authorized to furnish electrical power to Wapakoneta, Ohio.

This statement is in error as Ohio Power is now serving them. Central Ohio Light & Power Co previously served this community.

Philip Torchio, Jr
Assistant General Manager
Ohio Power Co
Canton, Ohio





*Type KO-L, with Load Break

Only CHANCE KO gives you all these features

There's a big difference in cutouts! *Overall protection* throughout the entire interruption range—all-weather operation—positive fuse coordination—low radio noise level . . . are just a few important things to look for when choosing *your* cutouts.

Compare the CHANCE KO with any other cutout. Compare it electrically. Compare it mechanically. Test it from maximum rated interruption to your lowest currents . . . you'll find that the CHANCE KO gives top performance because the KO is the basic design for the type KO-L—which is built for load break operation.

Order through your regular supplier—specify CHANCE KO or KO-L.

1 LOAD BREAK device, optional, Type KO-L*.
2 *Overall Protection*—Proved by thousands of tests.
3 *Pry-Out Lever* for easy opening and closing. Allows the use of heavy duty contact springs without requiring extra effort to remove tube.
4 *Exclusive Ejector Mechanism* provides fast complete ejection of fuse link before contacts part—even on a low current interruption.
5 *Sleet Shields for All-weather Operation.* Protect contacts and operating mechanism and prevent water from entering the tube to cause twisting and swelling of the fiber.
6 *Mechanical Time-Delayed Contact Separation.* Prevents pitting or burning of contacts.
7 *Pivot Bracket* (E.E.I.—NEMA) for cross-arm mounting. A special bracket is available for pole mounting.
8 *Positive Semaphore Indication* to show if cutout was opened manually or by a protective operation.
9 *Easy Reloading*—simple hook stick operation from any angle.
10 *Link Element Protection*—Link tension not affected by closing action. Eliminates breakage or damage to time-current characteristics of link.
11 *Overtravel Stops*—Protect pressure contact springs.
12 *Safety to Operator*—Tube angle directs expulsion gases away from lineman when operating cutout.

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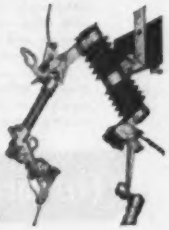
ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

* Chance Type KO-L gives load break operation with full interrupting capacity. It's not just a cutout with a load break attachment—it's *built to break loads.* This load break costs only $2.00 extra! Get full information today.



C52-11

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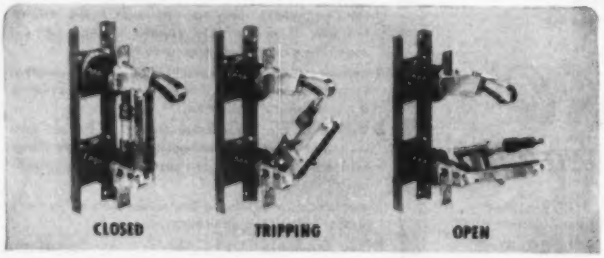
Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.



for interrupting high voltage circuits in air without external arcing or contact burning..

3E AIR INTERRUPTER SWITCHES

Loads up to 600 amperes at 15,000 volts can be opened with these 3E switches. Magnetizing currents of transformers and charging currents of lines and cables are also efficiently interrupted.

Switches are available for hook stick or group operation in either open or enclosed styles . . . and can be supplied in combination with power fuses for economical overload and short circuit protection.

For full details write for Booklet

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

WHAT THEY'RE SAYING

At Industry Meetings

Formula for Reform

HAROLD BRAYMAN, Director, Public Relations Dept, E. I. duPont de Nemours & Co, before annual meeting of the Paint and Varnish Production Clubs, Atlantic City, N. J.

The major problem facing American business today is that of winning a favorable public opinion. American business is confronted with a strange and confusing paradox. It has failed to gain for itself the same degree of acceptance and confidence that it has won for its products.

During the depression, political aspirants found it was popular to blame somebody for the nation's troubles and the businessman was the prime and biggest target. As a result a whole generation grew up exposed continually to the contention that the business or industrial leader was a rascal.

Unfortunately the business enterpriser, the production genius, and even the scientist, who have furthered our progress a great deal are often remembered less favorably than those who have had eloquent things to say about it later on. Business even more than the political leader desires the highest possible standard of living for all people, because that condition is the best suited to its own prosperity.

Our standard of living is the simple arithmetic of dividing the quantity of goods available by the quantity of productive effort going into it. The quotient is the measure of the living standard. When we increase the supply of goods in its relation to productive time we then step up our scale of living.

Expansion of Selling Machinery

J. M. McKIBBIN, vice president in charge of consumer production, Westinghouse Electric Corp, before the Adcraft Club at Detroit, Mich.

There is a real need to expand America's sales plant to match the expanding physical plant in order that American industry will emerge from its present expansion program with the greatest facilities to produce that this country has ever known. Gearing our selling machinery to the expansion of our production machinery will keep our factories running, our em-

ployment at a high level and our economy healthy.

In the last ten years the number of salesmen in this country has increased only 18% in comparison to an 80% increase in the physical volume of goods sold. The basic selling techniques have almost been forgotten, because since the war products have moved without any real sales effort.

Product claims that cannot be supported by the product in operation have no place in the development of the sales plant. Westinghouse, besides expanding its selling machinery is at the same time engaging in a major plant expansion program. Each manufacturing division has developed a long range marketing program which sets future goals and plans for the necessary selling machinery to reach these objectives.

Our Greatest Opportunity

CLARENCE J. McCORMICK, Under Secretary of Agriculture before the Columbia Basin Field Committee at Portland, Oregon.

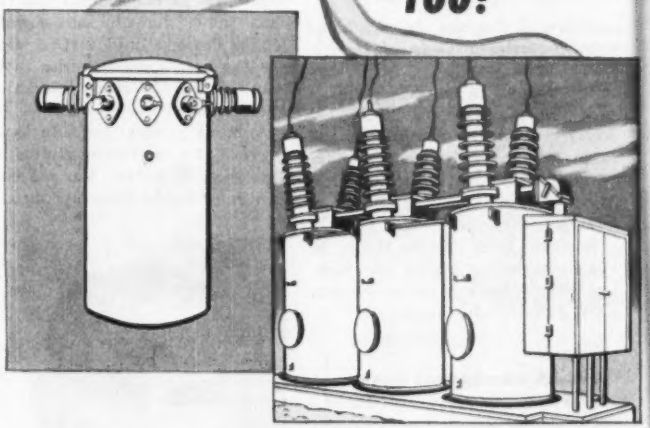
The challenge that faces us in the field of land and water conservation has been brought more sharply into focus for many people as a result of recent flood disasters in the Midwest. Because television has brought the devastation and ruin caused by floods into the living rooms of the nation, people are now becoming cognizant of the nation's flood problems. As bad as these floods may seem on the main stream the estimated damage upstream in the tributary valleys is about 75% of the total. The damage is largely agricultural resulting in crop losses, land, road and bridge damage. It is upstream in this watershed territory above the big rivers and dams that we must devote our attention if we are going to harness our rivers.

The Columbia River Basin and the Pacific Northwest have a great future with major opportunities for growth and economic progress. This potential greatness however depends largely on the development of the Columbia River and its tributaries.

The electric power that can be developed from the Columbia's water affects the relative value of every other resource in the region. In the American part of the basin alone 35 million kw capacity of electric generation can be developed and this I am told represents 40% of the entire potential electric power capacity of the nation.

DBPC Inhibited Oil

in Circuit Breakers, too!



WHEN DBPC (Di-tert-butyl-para-cresol) is added to transformer insulating oils, their resistance to oxidation is increased and their useful life is greatly extended. The value of Koppers DBPC as an inhibitor for new or reclaimed oil has long been proved.

Now, it has been shown that DBPC-inhibited oil can also be used in circuit breakers. The oxidation inhibitor, DBPC, does not affect arcing time, rate of gas generation, rate of carbon formation, rate of carbon settling or rate of dielectric change.

For longer oil life, for greater resistance to oxidation . . . specify Koppers DBPC. It can be used in both transformers and circuit breakers and thus, simplifies inventory problems.

Most suppliers furnish DBPC inhibited oil on request. For your convenience we can supply a compounded oil solution of DBPC called Improval 20. The application of Improval 20 is as simple as the application of the insulating oil itself. Write for more information on use of DBPC inhibited oil in transformers and circuit breakers.

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NEWS ABOUT PEOPLE

NEHEMIAH BOYNTON, JR

Boynton Is Appointed Head of Haartz-Mason

Nehemiah Boynton, Jr, vice president and sales manager of Haartz-Mason, Inc, Watertown, Mass., has been advanced to the post of president. He replaces the firm's co-founder, Jesse H. Mason, who has moved into the newly created position of chairman of the board. Haartz-Mason's new vice president is Laurence R. Clarke.

Boynton joined Haartz-Mason in 1945 when he was elected sales manager. That same year he also became a vice president and director.

•

Edmund S. Mortimer has been named manager of operations of Eastern Shore Public Service Co, Salisbury, Md. Mortimer, who joined the utility in 1926 as an electrical engineer, has served as manager of transmission and distribution.

George E. Burens, general manager of General Electric Co's Switchgear and Control Division, will serve as acting general manager of the switchgear department when **Robert F. Tinnerholm** retires from that post Sept. 1. Tinnerholm, who was named to the general manager's post in 1947, joined GE in 1907.

Dr Philip Miller has been appointed laboratory director for Walter Kidde Nuclear Laboratories, an organization which engages in research, development, and experimentation for the design of nuclear power plants. He formerly was associated with the Tennessee Valley Authority.

Vepco Names District Manager, Reassigns Five

Virginia Electric & Power Co has announced the following personnel changes:

Oakley E. Vermilya, formerly assistant engineer with the electric distribution department at Clifton Forge, Va., has been named manager at Hinton, W. Va. John G. Hanes, formerly manager at Hinton, has been appointed assistant to the district manager at Alexandria, Va.

P. W. Smith, formerly sales supervisor of the Potomac District at Alexandria, has been made director of residential sales, system sales department, at Richmond, Va. E. L. King, formerly sales supervisor in the sales department at Portsmouth, Va., succeeds Smith. Formerly sales engineer for the Potomac district, H. H. Dabney has been appointed sales supervisor of the Alleghany district at Clifton Forge.

Arthur E. Gasch, formerly junior engineer with the electric distribution department at Fairfax, Va., has been named distribution supervisor there.

A. CALLAWAY ALLEN

Appointed Sales Manager

A. Callaway Allen has been named sales manager of the Electrical Division of Wagner Electric Corp, St. Louis, Mo. He succeeds H. A. Hudson, who has a new position as sales analyst for the company. Allen, who began his career with Wagner in 1930, served as manager of Wagner's electrical sales branch at Memphis, Tenn., until his recent promotion.

J. B. FRENCH

French Named President of North Central Group

J. B. French is the new president of North Central Electric Association. French, who started his utility career in 1910, is now serving as president and on the board of directors of Black Hills Power & Light Co and Southern Colorado Power Co.

He also was president of the Rocky Mountain Electrical League in 1946.

•

Raymond T. Leary has been made sales manager of Cornell-Dubilier Electric Corp's Jobber Division effective Sept 1. Since 1949 he has been industrial sales manager of the firm's Chicago sales office.

Thomas M. Reed has been made supervisor of electric transmission and distribution for the Springfield district of Ohio Edison Co. Reed, manager at Ashland since 1947, will take over his new post Sept. 1.

W. A. Finn has been named assistant general sales manager of Worthington Corp, Harrison, N. J. Finn has returned from Paris, France, where he has been serving as general European manager, to make his new headquarters at the Harrison office. He joined the firm in 1926 as an application and sales engineer in the Steam Power Division.

Henry C. Egerton has been appointed treasurer of BullDog Electric Products Co, Detroit. He formerly was treasurer for U. S. Rubber Reclaiming Co, Inc, Buffalo, N. Y.

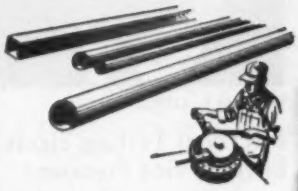
RYERSON

Steel Department Store for Electric Utilities

Here are a few of the many types of steel and related products on hand right now, ready for immediate shipment from your nearby Ryerson plant. Many may be used in place of products that are still hard to get. Check the items you need, and save time by ordering them next time you call Ryerson.

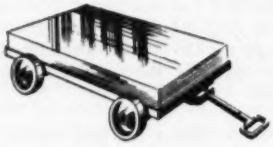
ALLOYS

Tested alloys of known hardenability, both standard and aircraft quality. Complete heat treatment guide with each shipment.



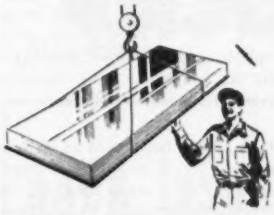
WELDED MECHANICAL TUBING

Hot and cold rolled, rounds and squares in a wide range of sizes. Consider cost. Substitute for seamless tubing.



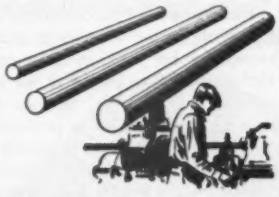
CARBON SHEETS

Both hot and cold rolled coming into better supply, especially cold rolled in the heavier gauges.



STRAIGHT CHROME STAINLESS

No allotment required for these stainless bars, plates and sheets—and they can often replace restricted nickel-bearing types.

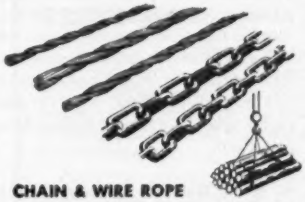


TOOL STEEL

Water, oil or air hardening steel. High in quality; economical in price. Hardening data with every shipment.

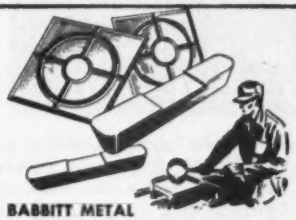
SAFETY PLATE

Strong, non-skid Inland 4-Way Safety Plate protects feet against slipping, floors against wear. Easily fabricated.



CHAIN & WIRE ROPE

Rugged, dependable TM chain, iron, steel and alloy qualities, furnished to order. High quality wire rope shipped from large stocks.



BABBITT METAL

Glyco Babbitt, an exclusive Ryerson product, has physicals equal to high tin Babbitts; costs substantially less and is unrestricted.

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JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETROIT
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

WILLIAM F. LITTLE

Electrical Testing Elects Little a Vice President

William F. Little has been elected vice president of Electrical Testing Laboratories, Inc. In addition to filling the new post, he will retain his duties as head of the photometric department, a position he has held since 1910.

Little, who has been associated with Electrical Testing since 1903, is well known for his work in the field of photometry. Best known of his contributions to lighting progress has been his original work in photometry contributing standard specifications for motor vehicles, industrial, commercial, motion picture, and natural lighting.

Active in the Illuminating Engineering Society for more than 27 years, he was president of the organization in 1930. He also served as vice president, treasurer, and director. In 1944 he became one of the first ten to receive the society's grade of "fellow" and was first chairman of the board of fellows. In 1950, Little was awarded IES's Gold Medal.

•

H. W. Petty has been appointed sales manager of R. E. Uptegraff Manufacturing Co, Scottdale, Pa. Petty, with Uptegraff since 1950, will maintain offices in Pittsburgh.

J. L. Bauer has been appointed assistant to the vice president and general sales manager of National Electric Products Corp, Pittsburgh. The company also named **George W. Hartner** director of advertising and publicity. Bauer, with National Electric since 1923, has been service manager in Pittsburgh since 1947. Hartner, advertising and sales promotion manager of the company since 1945, joined National Electric in 1941.

Donald R. Jenkins has been named manager of the newly formed gas turbine application engineering section of the Steam Division of Westinghouse Electric Corp at South Philadelphia, Pa. Jenkins, who started with the company in 1940, has been an application engineer in the electric utility department of Westinghouse's district office at Salt Lake City, Utah, since 1951.

Everett D. Learned has retired as an industrial and commercial power sales engineer after serving 40 years with Worcester County Electric Co, Worcester, Mass. He has established offices as an engineering consultant at 4 Walnut St., Worcester.

Arnold Kneitel, formerly with General Electric Co, has been appointed to the sales staff of Bishop Manufacturing Corp, Cedar Grove, N. J. In his new position he will be associated with the development of new applications for Bishop's products. He also will supervise sales engineering activities relating to silicone.

D. D. Clarke has retired as consulting engineer for Kansas City Power & Light Co after more than 40 years' service with the utility. A graduate of the University of Michigan, he first served as an engineer for Westinghouse Electric Corp at Pittsburgh before joining Kansas City P&L in 1911.

Frank J. Leeming has joined the application engineering staff of Sprague Electric Co, North Adams, Mass. He will specialize in customer manufacturing problems in the high-temperature magnet wire field. Prior to joining Sprague, he was with Bendix Aviation Corp.

W. Irving Hubbell, Southern Division engineer for Connecticut Light & Power Co, succeeds **Edwin A. Harris** as Southern Division manager for the utility. Harris, who has filled the manager's post since 1939, has retired after 32 years' service, although he will be retained as a consultant. **Daniel R. Forger,** Greenwich district engineer, replaces Hubbell and **Edward A. Whelan** succeeds Forger as Greenwich district engineer.

J. A. McBRIDE

McBride Is Promoted

J. A. McBride has been named general manager and vice president in charge of sales of Buell Engineering Co, Inc, New York. McBride has been sales manager of the firm since 1938.

•

E. William Cowdry, formerly assistant treasurer and manager of advertising and public relations for Iowa Power & Light Co, Des Moines, is now manager of Appliance Merchandisers Association, Arizona.

Earl F. Adams has been named assistant chief engineer of Weston Electrical Instrument Corp's Tagliabue Division. Adams, formerly pyrometer group chief of the division, joined Weston two years ago.

OBITUARY

Charles G. Bill, 82, retired vice president of Connecticut Power Co, died at Hartford, Conn., Aug. 7. Bill organized and developed the Union Electric Light & Power Co in 1901. In 1928 Union company properties were purchased by Connecticut Power and when the two companies merged in 1936, Bill became vice president. He retired in 1946.

H. A. Van Eaton, Sr, 73, assistant secretary and treasurer of Houston Lighting & Power Co for 28 years, died July 28.

Lewis H. Daniels, 41, industrial manager for the Detroit branch of Westinghouse Electric Corp, died Aug. 5.

Sectionalizing Devices

(*Continued from page* 101)

Fig 5 is a typical operating cycle for a 100-amp recloser set for one instantaneous and three time-delay operations. As shown, the maximum time to not lockout for the given current condition, is the sum of the time intervals of current flow for the first three operations of the recloser plus the time which current can flow during the fourth operation without tripping and locking out the mechanism.

Substation Recloser . . . The substation recloser chosen for feeder A is rated 70-amp, 3 phase, with a minimum tripping current of 140 amp, which represents approximately three times full load on the 1,000-kva transformer. The interrupting rating of this recloser on a 7,200/12,470-v Y system is 2,000 amp, which is adequate for the calculated interrupting duty of 880 amp at the substation. The curves of Fig 3 show the extent of overlapping protection that the recloser affords the fuses at A3 and A5.

The lower recloser curve is the tripping characteristic for the initial opening of the recloser, which is set for one instantaneous and three time delay operations. The upper curve represents the maximum time which current can flow through the recloser during its cycle of operations, without causing the recloser to open for its fourth or lockout operation. These two curves extend over a current range from 140 to 880 amp, the former being the smallest current which will trip the recloser and the latter the maximum interrupting duty at the substation.

It is seen that, between these current limits, the recloser curves enclose a major portion of the band curves for the fuse links at A3 and A5. The portion of the fuse curves lying within the recloser curves indicates the range of fault currents over which the recloser protects the fuses against outages due to temporary faults. Branch fuses at A4 and A6 being 25-amp fuses are also protected for faults on their respective branches to the same extent as the 25-amp fuse at A5. The portion of the fuse curves which does not fall within the recloser curves indicates that overlapping protection is not entirely complete for the locations chosen and that for high impedance faults between 113 and 140 amp, some undesirable fuse outages may result.

count these *extras* in

WEAVER

jumper clamps

armor rod jumper clamps

- One size for all requirements from #8 solid copper to 1/0 ACSR over armor rods.
- Cast of high strength bronze alloys. Plating removed from one groove for aluminum or steel to copper connections.
- Extra length bolts for ease of installation.
- Lockwashers prevent loosening.
- Jumper clamps ideal for use with aluminum service drop cable.

J. A. WEAVER CO.

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BACK ISSUES

to work

Whatever you do with this magazine after you've clipped pertinent articles or advertisements, *please don't destroy it.*

HERE'S WHY:

Churches, Boy Scouts, civic and veterans organizations will welcome all the wastepaper you have. They can get a good price for it. Increase their funds.

And, you can make a direct contribution to American mobilization by saving paper of all types—whether in magazine form or not. Since the Korean War began, there's been a great increase in the demand for products manufactured from wastepaper.

Save it for your favorite organization. Chances are they have scheduled pick-ups.

LOOK... FOR THE YELLOW TRIANGLE -

a symbol of Wickwire Quality when you're buying wire rope. It's your assurance of utmost stamina and uniformly dependable performance ..longer, more economical service on the job.

Write for free copy of "Know Your Ropes" —82 pages of helpful information on selection, application and correct usage of wire rope. Address your request to: Wire Rope Sales Office, Palmer, Mass.

The Colorado Fuel & Iron Corporation, Denver, Colorado
The California Wire Cloth Corporation, Oakland, California
Wickwire Spencer Steel Division, Palmer, Massachusetts

WICKWIRE ROPE

BRANCHES IN ALL KEY CITIES

MANUFACTURERS & MARKETS

Shipments of Air-Conditioning and Refrigeration Equipment *
(Value Figures in $000)

Class of Product		1951	1950	1949
Condensing Units	Units	840,176	885,913	610,341
	Value	$75,672	75,833	53,534
Compressors and Compressor Units	Units	1,051,937	954,368	604,431
	Value	$56,669	46,977	39,959
Heat-Exchanger Equipment	Units			
	Value	$65,077	61,337	40,925
Self-Contained Air-Conditioning Units	Units	282,488	257,263	123,709
	Value	$93,573	86,913	50,384
Centrifugal Refrigeration Systems	Units	441	382	285
	Value	$15,300	12,249	8,189
Ice-Making Machines	Units	12,998	14,914	6,902
	Value	$8,804	8,907	4,641
Total	**Value**	**$315,095**	**292,216**	**187,802**
Refrigeration Chassis for Air Conditioning Year-Round Air Conditioners (Self-Contained — Except Heat Pumps)	Units			
	Value	$5,863		
Mechanical Dehumidifiers, Refrigeration Type	Units	75,659	Not Available for Previous Years	
	Value	$4,731		
Absorption, Adsorption Systems and Equipment	Units	138		
	Value	$1,839		
Grand Total	**Value**	**$327,528**		

* Source: Dept. of Commerce, Bureau of the Census, "Facts for Industry" Report M52A

Air-Conditioning Shipments Up

There has been an upward trend in the shipments of air-conditioning and commercial refrigeration equipment for the years 1949 through 1951, according to figures released recently by the Bureau of Census, Department of Commerce. This upward trend also was accompanied by an increased electrical horsepower air-conditioning load (see table below).

Figures revealing this information were contained in the bureau's pamphlet "Facts for Industry."

Value Increases 8% . . . Shipments of components and accessories for air-conditioning and commercial refrigeration equipment in 1951 were valued at approximately $213 million, up about 8% over 1950.

Shipments of condensing units in 1951 totaled 840,176 valued at $75,672,000. This represents a slight decline in value from 1950's $75,833,000 and a unit drop of 45,737.

A total of 1,051,937 compressors and compressor units, valued at $56,669,000, were shipped in 1951, representing increases of about 10% in number of units and about 21% in value compared with 1950.

Value of heat-exchanger equipment shipped in 1951 amounted to $65,077,000, an increase of about 6% over 1950, and shipments of centrifugal refrigeration systems, valued at approximately $15.3 million, showed a gain of about 25% over 1950.

Unit Output Rises 10% . . . Shipments of self-contained air-conditioning units amounted to 282,488 valued at $93,573,000 in 1951, representing a 10% and 8% increase, respectively, over 1950's units and value.

The bureau's figures on quantity and value of shipments represent completed sales of the equipment. The report presents data for all known companies manufacturing components and accessories for air conditioning and commercial refrigeration and complete air-conditioning equipment of types specified (see table left).

Figures Revised . . . The 1951 figures are based on reports received from 133 companies, which include reports from 35 companies that were not canvassed in 1950. Data for 1950, however, for virtually all of these companies were obtained during the 1951 canvass and the 1950 figures have been revised accordingly.

Therefore, the data for 1950 and 1951 are comparable for all types of air-conditioning and commercial refrigeration equipment included in the survey, except for refrigeration chassis for air conditioning, year-round air conditioners, and mechanical dehumidifiers. No comparable 1950 data are available for these items since they were included for the first time in 1951.

Electrical Horsepower Equivalent of Air-Conditioning Load*

Class of Product	Horsepower	
	1951	1950
Total Estimated Air Conditioning Load	**731,898**	**712,994**
Total — 30 Hp and Under	**511,001**	**519,693**
Total Packaged Air Conditioning Equipment	423,275	433,941
Room Air Conditioners	171,917	144,633
Self-Contained Air Conditioners	251,358	289,308
Comp. & Cond. Units, 7½-30 Hp	91,727	95,684
Total — Over 30 Hp	**220,898**	**193,369**
Comp. & Conditioning Units Over 30 Hp	97,818	91,689
Centrifugal Systems for Air Cond	119,070	91,680

* Based on Manufacturers' Shipments of Air Conditioning Equipment (Total Shipments — Export Included)
Source: Dept. of Commerce, Bureau of the Census, "Facts for Industry" Report M52A

Ceramic Paper Applicable to Electrical Insulation

A new synthetic product known as a ceramic paper was produced recently in the Naval Research Laboratory, Bethesda, Md. The paper, potentially valuable for electrical insulation, can be readily and cheaply made from domestic materials.

The Carborundum Co co-operated in the development by furnishing the basic material from which the paper and laminate were produced. The ceramic paper can be made by conventional paper-making methods from a material that closely resembles rock-wool and is essentially aluminum silicate, or any similar clay.

In the process developed at NRL, the black impurities which comprise about 60% of the basic material are removed in a fractionating box or "riffler," leaving about 30% in a fluffy white fibrous form and 10% in a granular form that appears suitable for thermal insulation. The fibrous material can be made into paper only because of the fineness of its fibers—individual fibers are much less than a micron (40-millionths of an inch) in diameter.

For paper-making purposes, bentonite clay, a material similar to fuller's

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earth, is added to the fiber. When the fiber is bonded with suitable resins it can be laminated into fireproof panels, easily machined or drilled, and capable of withstanding temperatures to 2,500 deg. Such panels would be useful for switchboard panels and similar installations where resistance to fire plus electrical insulation is needed.

An added characteristic of the product is that it contains no boron, which suggests application as electrical insulation for cables and various components which might be subjected to atomic radiation. Synthetic materials now available contain boron or similar chemical elements which trap the atomic particles called neutrons and so would become radioactive if used to insulate cables or other equipment used in the neighborhood of nuclear reactors of "piles."

Sylvania's Sales Set Record; Income Is Down

Sylvania Electric Products, Inc's sales for the first half of 1952 totaled $104,226,623, an all-time company record for a half-year's operations. Highest previous sales for a half year were reported during the first six months of 1951 when the shipments reached $103,822,579.

Sales for the second quarter of this year were $48,239,162, also a company high for a second quarter and nearly 12% more than the $43,191,494 reported for the same period in 1951.

Net income for the first half of 1952 was $3,398,776, equal to $1.48 per share of common stock, compared with $5,680,670, or $2.95 a share, in the first half of 1951.

For the second quarter of 1952, net income was $1,445,005, equal to 60¢ per share on common stock outstanding. This compares with net income of $2,165,515, equal to $1.11 a share in the second quarter of last year.

MANUFACTURING BRIEFS

Babcock & Wilcox Co has announced the development of an additive which, when mixed with fuel oil, keeps boilers in operation longer by eliminating clinkerlike deposits on boiler tubes. The additive was developed in the firm's research and development center at Alliance, Ohio.

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UTILITIES
Proposed Construction

Ala., Mobile—Pursley Broadcasting Service, Box 1306, television station, $152,200. George P. Adair, 1333 M. St., Wash., D. C., consult. engr.

Ariz., Phoenix—KTAR Broadcasting Co., 711 Heard Bldg., 16 N. Central Ave., Phoenix, television station, $512,600. George C. Davis, Munsey Bldg., Wash., D. C., consult. engr.

Calif., Fresno—John Poole Broadcasting Co., Security Bldg., Long Beach, Zone 2, television station, $288,000. T & T Radio Measurements Co., 2559 Atlantic St., Long Beach, consult. engr.

Calif., Stockton—John Poole Broadcasting Co., Security Bldg., Long Beach, Zone 2, television station, $240,000. George P. Adair, 1333 M. St. N. W., Wash., D. C., consult. engr.

Fla., Jacksonville—City, City Hall, two 750 KVA 3 phase vault type network units, Spec. 1069; eight 500 KVA 3 phase vault type network units, Spec. 1070.

Ill., Peoria—Television Co., 115 N. Jefferson St., television station, $305,000. Robert M. Silliman, 1011 New Hampshire Ave., Wash., D. C., consult. engr.

Ind., Evansville—Trans-American Television Corp., 1402 Walnut St., Phila., 2, Pa., television station, $190,900. A. D. Ring & Co., Munsey Bldg., Wash., D. C., consult. engr.

Kan., Topeka—S. H. Patterson, 908 Kansas Ave., television station, $174,200. Radio Eng. Co., 1355 Market St., San Francisco, consult. engr.

La., Lake Charles—U. S. Eng., 606 Santa Fe Bldg., Galveston, Tex. electrical dist. sys., Lake Charles Air Force Base, Eng 41-243-53-10.

Mich., Detroit—City, Carl D. Warner, Comr. P. Wks., City Hall, Cont. PW 1071-D, electric const. Freud Pumping Station, power transformers, switchgear, furnished by city. Plans deposit $15. G. R. Thompson, city engr.

Mich., Flint—Trendle-Campbell Broadcasting Corp., 1800 Mutual Bldg., 26 W. Adams Ave., Detroit, Zone 26, television station $298,660. Kear & Kennedy, 1302 18th St. N. W., Wash., D. C., consult. engr.

Minn., Minneapolis-St. Paul—Upper Midwest Television Co., 425 Portland Ave., Minneapolis, television station, $566,340. Craven, Lohnes & Culver, Munsey Bldg., Wash., D. C., consult. engrs.

Missouri—Sho-Me Power Corp., Marshfield, 46.18 mi. rural distr. lines, Phelps, Crawford and Franklin Counties, $65,000. Frank Horton & Co., Lamar, engr.

N. Y., Schenectady—Champlain Valley Broadcasting Corp., 444 Broadway, Albany, television station, $121,580. William L. Foss, Inc., 927 15 St. N. W., Wash., D. C., consult. engr.

O., Mansfield—Mansfield Journal Co., 70 W. Fourth St., television station, $350,300. Craven, Lohnes & Culver, Munsey Bldg., Wash., D. C., consult. engrs.

Oklahoma—K. A. M. O. Electric Cooperative, vicinity, four electric sub-stations, Craig Co. $100,000. W. R. Holway, 302 E. 18 St., Tulsa, consult. engr.

Okla., Altus—U. S. Eng., Box 61, Tulsa Zone 2, electric distr. sys. for Altus Air Force Base. $90,000.

Oregon—U. S. Eng., Pittock Block, Portland, power house, Lookout Point Dam, Lane Co. Civeng 35-026-53-20. $4,000,000.

Pa., Pittsburgh—Westinghouse Electric Corp., Union Bank Bldg., plans by Voorhees, Walker, Foley & Smith, 101 Park Ave., New York, N. Y., research laboratories, Churchill Boro. $1,000,000.

S. C., Spartanburg—The Broadcasting Co. of the South, 224 E. Main St., television station, $540,190, Craven, Lohnes & Culver, Munsey Bldg., Wash., D. C., consult. engrs.

Tennessee—Sequatchie Valley Electric Co-operative, Dunlap, 110 mi. rural distr. lines, Bledsoe, Sequatchie, Marion, Grundy, Van Buren and Hamilton Counties. W. M. Wilson, 511 Madison St., Shelbyville, engrs.

Tenn., Bristol—Radiophone Broadcasting Station WOPI, Inc., 310 State St., Union Trust Bldg., television station. $318,000. O. K. Garland, Johnson City, consult. engr.

Tex., Amarillo—Plains Radio Broadcasting Co., 8 and Harrison Sts., plans by Robert E. Hucker, Johnson Bldg., brick, masonry Television Studio, Station K G N C, 1800-2200 N. Polk St. $225,000; transmitter bldg. and installation all technical equip. and facilities for operation, ½ mi. northwest of River Rd. School. $495,000; television antennae, incl. 823 ft. high steel tower, ½ mi. northwest of River Rd. School. $100,000.

Tex., San Antonio—U. S. Eng., 606 Santa Fe Bldg., Galveston, electrical distr. sys., Brooke Army Medical Center, Fort Sam Houston, inv. No. ENG 41-243-53-14. CD television antennae, incl. 823 ft. high steel tower, ½ mi. northwest of River Rd. School. $100,000.

W. Va., Fairmont—Westinghouse Electric Corp., Fairmont, 2 story, 150x240 ft., brick, concrete, steel frame mfg. plant. $600,000.

Wyoming—Bureau Reclamation, Dpt. Interior, Cody, Wyo., Thermopolis Substation addns., Transmission Div., Missouri River Basin Proj., at Thermopolis, Spec. DC-3763.

Wyoming—Bureau Reclamation, Dpt. Interior, P. O. Box 280, Casper, furnishing labor and materials and performing all work for the const. of Laramie substation addns., Kendrick Proj. Spec. 703C-271.

Low Bidders & Contracts Awarded

Idaho, Arco—General Electric Co., River Road, Schenectady, N. Y., Aircraft Propulsion Project at Reactor Testing Station, Idaho, CA total cost, $33,000,000. Atomic Energy Comn., P.O. Box 1221, Idaho Falls, Idaho, Parsons-Macco-Kiewit Co., 617 S. Olive St., Los Angeles, Calif., made preliminary design studies under subcontract with prime contractor.

South Carolina—Service Electric Co., 608 Hectaclaw Ave., Chattanooga, Tenn., CA, $705,023, Pinewood Sub-station. Central Electric Co-operative, 20 Cornell Arms Bldgs., Columbia, S. C. Bids July 8.

Tenn., Fayetteville—City, c/o city engr., City Hall, Fayetteville, Tenn. Owner Builds. Approx. $140,000. imprvs. to city electric sys.

Wash., Richland—Kaiser Engineers, 1924 Broadway, Oakland, Calif., CA, expansion of Hanford Plutonium Works. For the Atomic Energy Comn., 1901 Constitution Ave. N. W., Wash., 25, D. C. Vitro Corp. of America, 2231 Broadway, New York, N. Y., Charles T. Main, Inc., 80 Federal St., Boston, Mass., engrs. General Electric Co., River Rd., Schenectady, N. Y., operating contractor, will furnish basic engineering design.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS
Proposed Construction

Ariz., Florence—Proven Oil & Refining Co. c/o L. M. Glasco, M & W tower Bldg., Dallas, Tex. 50,000 bbl. daily capacity gasoline refinery, $17,937,000.

D. C., Wash.—Acacia Mutual Life Insurance Co., 51 Louisiana Ave. N. W., Wash., D. C., plans by Shreve Lamb & Hermann Assocs., 11 E. 44 St., New York, N. Y. 6 story Annex, $3,000,000.

O., Cleveland—New York Central System, St. Clair Ave. and W. 3 St., plans by Friedman, Alschuler & Sincere, 228 W. Jackson Blvd., Chicago, Ill., parcel post annex and garage at W. 9 St. and Lakefront for lease to United States Post Office, Cleveland. $7,500,000.

Pa., Natrona—School Dist. of Harrison-Brackenridge Joint School Dist., Natrona, plans by John H. Phillips, 22 Briar Cliff Rd., Ben Avon Heights, Pittsburgh, high school and field house, $800,000; at Brackenridge: 2 story, bsmnt., brick, steel frame, Junior High school, $1,000,000 at Natrona Heights, Harrison Twp.

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POSITION OPEN for technical salesmen to handle alkaline storage batteries to industrial accounts. Must have mechanical or electrical engineering background plus selling experience on technical products which use batteries to utilities, railroads, manufacturing plants. Salary, expenses, and commission basis. Nickel Cadmium Battery Corporation, 100 Park Avenue, New York; telephone ORegon 9-1300, Mr. Hardy.

VACANT POSITION

C. A. LA ELECTRICIDAD DE CARACAS, supplying electric light and power service to the city of Caracas, capital of the Venezuelan Republic, is interested in obtaining the following technical services:

a) **CONSULTING ENGINEER:** For Electrical Distribution Department.—Experience in public utility companies for cities of more than 500,000 inhabitants is required, as well as excellent recommendations.
Approximate salary: $14,000.00 a year.

b) **ELECTRICAL ENGINEER:** With experience in projects and estimates for distribution systems. Approximate salary; $10,000.00 a year.

***Please address inquiries to* Dr. Ricardo Zuloaga, C. A. La Electricidad de Caracas, Marron a Pelota N° 6, Caracas, Venezuela.**

DISTRIBUTION ENGINEER

If you are a distribution engineer or a distribution superintendent with 10 to 15 years of electric utility experience and can meet our requirements, and if you are willing to live in a foreign country for three years we can make you a very attractive offer. Ability to get along with people, operate a power system and supervise contractors building a power system are prime requirements. Submit resume of experience, education, availability, etc., to

P-5056, Electrical World
330 W. 42 St., New York 36, N. Y.

ELECTRICAL DESIGNERS

and draftsmen wanted by an expanding organization for work in Chicago on the design of hydroelectric plants both foreign and domestic.

HARZA ENGINEERING CO.
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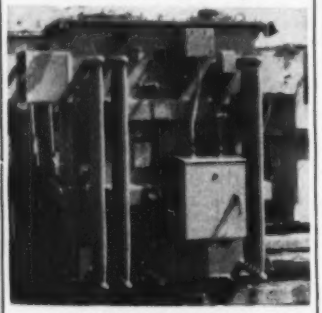

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1500- and 600-KVA, 3-ph., 60-cycle Power Centers. Each 1500-KVA unit includes two 750-KVA, 2400/480 V., Type OA Westinghouse transformers, and one set of metal-housed, 480-VAC switchgear. 600-KVA unit includes two 300-KVA, 2300/120/208 V. transformers, and set of 120/208 VAC switchgear.

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TRANSFORMERS — OIL & AIR BRKRS.
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wanted by the City of Escanaba, Michigan, to direct operation of municipally owned electric utility. Prefer applicants who have had a minimum of two years experience in utility operation. Must have degree in electrical engineering. Salary up to $5,400.00.

Address applications, giving full particulars, to A. V. Aronson, City Manager, Escanaba, Michigan.

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REPRESENTATIVES WANTED by manufacturer for sale of varnish and tubing. First grade varnished tubings and sleevings. Good connections with the Television and Radio industries are essential. RW-5045, Electrical World.

SALES, AGE 25-35, some technical background desirable contacting utilities industry, long-established specializing firm Chicago Branch. State age, education, experience, references, salary. SW-4437, Electrical World.

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SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven Conn.

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ELECTRICAL CONSTRUCTION Engineer, B.S. E.E. '53. Experience: industrial design, estimating, line construction. Desires position with opportunity for advancement in larger organization. PW-5048, Electrical World.

POSITION WANTED

Executive Engineer with 25 years active experience in Supervisory Capacities of Engineering and operations for large electric utility, and Electric Consultant for large industrialists. Desires connection in administrative capacity with progressive organization offering challenging work and opportunities. Good personality, married. Excellent health and U. S. citizen.

PW-5029, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

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RA-5131, Electrical World
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U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3767) will be received at Denver, Colorado, until September 11, 1952, for furnishing control, recording, and AC distribution boards; two 300-kva, 3-phase, 7,200- to 480-volt station-service transformers; and, two 70-ampere, 125-volt battery chargers for Eklutna Power Plant, Eklutna Project, Alaska. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. DC-3772) will be received by Bureau of Reclamation, Denver, Colorado, until September 9, 1952, and then publicly opened for furnishing and installing four 30,000-kva, 95-percent power factor, 163.6-rpm, 11,500-volt, 3-phase, 60-cycle, vertical-shaft, alternating-current generators; complete with protective equipment assemblies, for Palisades Power Plant. The Palisades Dam and Power Plant will be located on the South Fork of the Snake River, approximately 7 miles southeast of Irwin, Idaho. Time allowed for completion will be 1,360; 1,450; 1,540; and 1,630 days for the four generators, respectively. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

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SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	500	Pitts.	66000-13200/7620 Y
2	333	G. E.	69000—2400/7200
3	200	Pitts.	66000—2300
2	75	A. C.	66000/24000—7200/12470 Y
3	200	West.	44000-2400/7200
4	150	West.	44000/33000—2300/6900
3	100	G. E.	44000—2300
3	75	West.	44000—7200/12470 Y
3	8333	West.	43800—13900
3	5000	G. E.	38100/66000—6800
1	15750	A.B.B.	34840—11000, 3 ph.
2	900	G. E.	33000—2300, 3 ph.
4	200	A. C.	34500—6900/11950
4	200	G. E.	34500—230/460
3	100	West.	33000—240/480 NEW
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
4	450	A. C.	25410/44000—13280/23000
2	1000	G. E.	23000—7200/12470 Y
9	50	G. E.	22000—2300
3	37½	G. E.	22000—6900
2	200	G. E.	13200—2300
3	200	G. E.	13200—230/460
4	750	G. E.	11000—440
3	250	Pitts.	7200—230/440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
2	100	G. E.	4800/2400—480/240
1	1500	A. C.	2300/4000 Y—2300
3	333	G. E.	2300—230/460
1	100	G. E.	2300—575, 3 ph.
3	100	West.	2300—460/230
6	50	West.	2400—114/228 DRY TYPE
3	20	West.	2200—575

INDUCT. REGULATORS—OUTDOOR

1— 140 KVA G. E. 200 A. 4000 V. 3 ph.
4— 60 KVA West. 250/500 A. 2400 V. 1 ph.
6— 48 KVA G. E. 200 A. 2400 V. 1 ph.
3— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

1— 600 A. 73 KV G. E. FHKO-236-500 MVA
1— 600 A. 37 KV G. E. FHKO-236-500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
1— 600 A. 15 KV G. E. FHKO-139-750 MVA
1— 600 A. 15 KV G. E. FHKO-136-1328 BS
1— 600 A. 15 KV G. E. FHKO-136-350 MVA

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3333 KVA, 1 Phase, 60 Cycle, 38,100 v./33,000 v. with high voltage taps at 40,000—36,200, 34,200 v. Impedance 8.1%, water cooled.
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SIX OIL INSULATED WATER COOLED TRANSFORMERS
833 KVA, 60 cycle, 22900 primary, 2300 secondary, and 3 Westinghouse transformers, 75 KVA, 2300 primary, 230-460 secondary.
KLATZKY BROTHERS, INC.
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DIESEL ENGINES
2—Used 6 cylinder, 420 HP, Fairbanks Morse, type VA diesel engines with direct connected 265 K.W. generators available now.
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TURBO GENERATORS

Qu	KW	Make	Desc.
1—	6000	Al. Ch.	Condensing 200 250 I.S.P. 2300 v 3/60 Exc & Surf co Cond.
1—	750	G.E.	Condensing — 425 lbs. 750 TT I.S.P. 440 v 3 ph. 60 cy.— Built 1944
1—	500	Moore	Non-condensing 150/200 lbs. I.S.P. 5 35 lbs. G.B.P. 3 /60/480 volt Direct Connected Exciter
1—	400	Westg.	Non-condensing — 125/150 lbs. I.S.P. 5/10 lbs. B.P.— 240/480 v. 3 ph. 60 cy.
1—	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.— 480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
1—5000	Whse.		2400/4150	600

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	9600/13200
2—	2000	G.E.	900	600 25 cy.	11000
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2300/4600
3—	1500	G.E.	514	250	9600/13200
1—	1000	G.E.	900	250	4100/6900
1—	1500	G.E.	600	600	2300/4150
2—	1000	Whse.	900	600	2300/4150
1—	500	Whse.	900	250	9600/13200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	350	G.E.	900	125	4150
1—	150	G.E.	1200	275	2300
1—	150	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
2—1250	G.E.	BVDDJ		6600x550
1—1150	A.C.	OISC		13200x480/2400
3—1000	G.E.	BVDDJ	1	2200x480
9— 300	G.E.	BT	3	24000x240/480

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KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1136	Fairbanks Morse	38D	1600	720	220	Enterprise	DSC-6	450	450
1100	General Motors	16-278A	1600	720	300	General Motors	3-268A	450	1200
750	General Motors	12-567	1080	720	200	General Motors	6-268A	300	900
500	General Motors	8-278A	750	720	100	General Motors	3-268A	150	1200
500	General Motors	8-567	720	720	100	Worthington	BB-8	150	900
350	Baldwin	VO-6	510	450	60	General Motors	6-71	90	1200
320	Buckeye	80	480	600	30	Internat'l Harvester	UD-14	45	1200

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1—1500 KVA G.E., 3 Ph., 4160Y, 2300Y Pyranol
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1— 200 KVA G.E., 3 Ph., 2400-220 Sec.
3— 100 KVA Wagner, 1 Ph., 240Y prl., 120Y sec.
6— 50 KVA G.E., 1 Ph., 13,450Y, 120/240 Sec.

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1— 150 H.P., G.E., 1800 RPM, 220V.
2— 150 H.P., Al. Chal. 360 RPM, 440V.

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1— 200 KW Whse., 275V, 900 R.P.M., 220 V 3ph.
1— 175 KVA Wood., 1Ph., 220V. Motor 3Ph., 440V
1— 150 KW. G.E., 125/250V, 1200 RPM, 2300 3ph
1— 100 KW G.E., 250V, 900 RPM, 2300V, 3ph.
1— 75 KW C.W. 220V, 1200 RPM, 2300/3150V3ph.

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1— 250 HP West., CW, 600 RPM, 440V

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1—2500 KVA Whse., 720 RPM, 2200V with DCEXC.

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NOT THE FARM VOTE...
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THE LABOR VOTE...
OR ANY PARTY VOTE...

Politicians talk a lot about this and that "bloc" of voters being decisive factors in this election. So do all the pollsters. You can't blame them for trying to dope it out that way in advance . . . but . . .

YOU know you're going to vote your own sweet way when you get behind that voting booth curtain—that where you live or work hasn't got a blankety-bloc thing to do with how you'll vote. You'll vote for what you believe to be in the best interests of your family—your kids—and your kids' kids.

So YOU know that this year—as always—it will be the FAMILY vote that really decides things. And families are working as never before to make sure every American votes. Right now in millions of American families, everyone from Little Sis to Grandma is pitching in to remind every eligible American to register to make sure of the opportunity to vote. And then they'll tackle the job of getting out the vote of every member of America's 44,000,000 families. They're the biggest "bloc" in America—they ARE America!

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5/8% Step
Voltage Regulators

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And you get reliability with Allis-Chalmers distribution regulators. Eight years of field experience has proved that they give you trouble-free operation. Besides, Allis-Chalmers regulators are backed by 20 years of 5/8% step voltage regulator development.

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A-3835

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	5000 VOLTS — 50-100 AMPS
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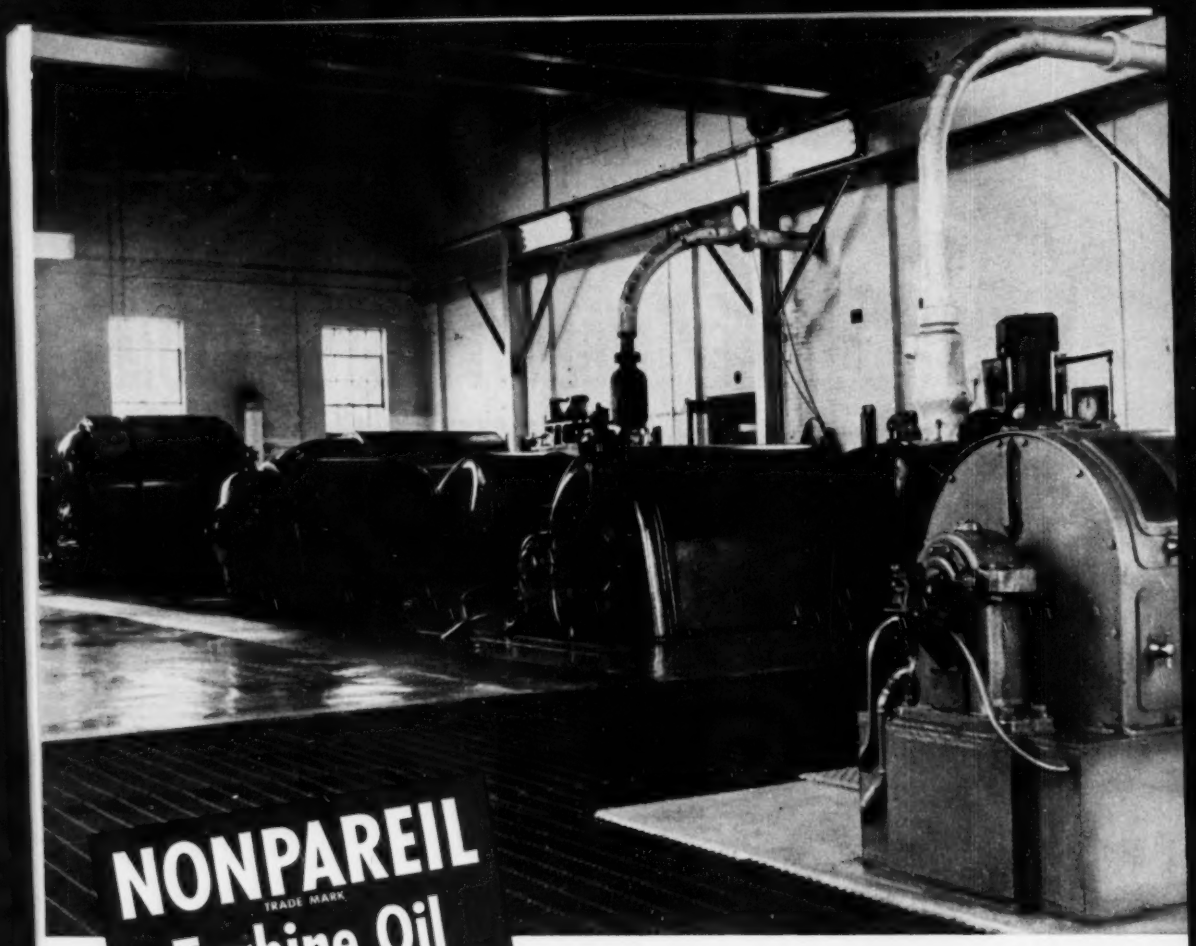

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